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Term: L17 and prefix$

Display: 10 **Documents in Display Format:** KWIC **Starting with Number** 1

Generate: ○ Hit List ◉ Hit Count ○ Side by Side ○ Image

Search Clear Interrupt

Search History

DATE: Wednesday, February 16, 2005 Printable Copy Create Case

Set Name side by side	Query	Hit Count	Set Name result set
	DB=USPT; PLUR=YES; OP=ADJ		
L26	L17 and prefix$	1	L26
L25	L19 and (prefix$ with (compar$ or updat$ or replac$ or chang$))	1	L25
L24	L19 and prefix$	1	L24
L23	L19 compar$	0	L23
L22	L19 and (PTSE with (updat$ or chang$ or replac$))	1	L22
L21	L20 and (PTSE with (updat$ or chang$ or replac$))	1	L21
L20	L19 and PTSE	1	L20
L19	6208623.pn. applied	1	L19
L18	L17 and PTSE	2	L18
L17	(6606303 or 6243384 or 6208623 or 6002674).pn.	4	L17
L16	L7 and ((replac$ or chang$ or updat$) adj3 prefix)	0	L16
L15	L7 and prefix	16	L15
L14	L7 and (chang$ adj3 address$)	6	L14
L13	L7 and (chang$ with address$)	14	L13
L12	L7 and ((replac$ or chang$ or updat$) with address$)	20	L12
L11	L7 and SIG	5	L11

L10	L7 and SIG	5	L10
L9	L8 and (compar$ adj3 address$)	2	L9
L8	L7 and ((replac$ or updat$) with address$)	15	L8
L7	L4 or L5	74	L7
L6	L3 and PNNIATM	0	L6
L5	L3 and PNNI	74	L5
L4	L3 and (PTSE or PTSP)	11	L4
L3	709/$.ccls.	17245	L3
L2	L1 and ((replace$ or updat$) with (address$ adj2 compar$))	27	L2
L1	routing.ab.	7186	L1

END OF SEARCH HISTORY

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L24	L19 and prefix$	1	L24
L23	L19 compar$	0	L23
L22	L19 and (PTSE with (updat$ or chang$ or replac$))	1	L22
L21	L20 and (PTSE with (updat$ or chang$ or replac$))	1	L21
L20	L19 and PTSE	1	L20
L19	6208623.pn.	1	L19
L18	L17 and PTSE	2	L18
L17	(6606303 or 6243384 or 6208623 or 6002674).pn.	4	L17
L16	L7 and ((replac$ or chang$ or updat$) adj3 prefix)	0	L16
L15	L7 and prefix	16	L15
L14	L7 and (chang$ adj3 address$)	6	L14
L13	L7 and (chang$ with address$)	14	L13
L12	L7 and ((replac$ or chang$ or updat$) with address$)	20	L12
L11	L7 and SIG	5	L11

L10	L7 and SIG	5	L10
L9	L8 and (compar$ adj3 address$)	2	L9
L8	L7 and ((replac$ or updat$) with address$)	15	L8
L7	L4 or L5	74	L7
L6	L3 and PNNIATM	0	L6
L5	L3 and PNNI	74	L5
L4	L3 and (PTSE or PTSP)	11	L4
L3	709/$.ccls.	17245	L3
L2	L1 and ((replace$ or updat$) with (address$ adj2 compar$))	27	L2
L1	routing.ab.	7186	L1

END OF SEARCH HISTORY

L8

Refine Search

Search Results -

Term	Documents
REPLAC$	0
REPLAC	19
REPLACA	1
REPLACABILITY	79
REPLACABLE	1257
REPLACABLEY	1
REPLACABLE-FLAG	1
REPLACABLY	188
REPLACAED	4
REPLACARDING	2
REPLACATED	2
(L7 AND ((REPLAC$ OR UPDAT$) WITH ADDRESS$)).USPT.	15

There are more results than shown above. Click here to view the entire set.

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Search: L8

Refine Search

Recall Text

Clear

Interrupt

Search History

DATE: Wednesday, February 16, 2005 Printable Copy Create Case

Set Name side by side	Query	Hit Count	Set Name result set
	DB=USPT; PLUR=YES; OP=ADJ		
L8	L7 and ((replac$ or updat$) with address$)	15	L8

dyna

L5/6, 5, 7, 8, 8, 13

L7	L4 or L5	74	L7
L6	L3 and PNNIATM	0	L6
L5	L3 and PNNI	74	L5
L4	L3 and (PTSE or PTSP)	11	L4
L3	709/$.ccls.	17245	L3
L2	L1 and ((replace$ or updat$) with (address$ adj2 compar$))	27	L2
L1	routing.ab.	7186	L1

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Search Results - Record(s) 1 through 10 of 15 returned.

☐ 1. Document ID: US 6820134 B1

L8: Entry 1 of 15 File: USPT Nov 16, 2004

DOCUMENT-IDENTIFIER: US 6820134 B1
TITLE: Optimizing flooding of information in link-state routing protocol

Detailed Description Text (54):
(b) Examine every interface on the P2mpIntList 526 and perform the following: Compare the LSA being flooded with the one identified by the LSASent field 720 of the interface data structure 700. If the LSAs are the same, the LSA has already been sent on this interface and the next interface in the P2mpIntList 526 must be considered. Send the LSA in a link state update packet setting the destination address according to the rules in Section 13 of the RFC 2328. Set the LSASent field 720 of the interface data structure 700 to the LSA that has just been sent.

Detailed Description Text (58):
(b) Examine every interface on the P2pIntList 524 and perform the following: If the interface FloodingActive field 710 is clear, skip this interface and consider the next interface in the list. Send the LSA in a link state update packet setting the destination address according to the rules in Section 13 of RFC 2328.

Current US Original Classification (1):
709/238

Current US Cross Reference Classification (1):
709/242

Other Reference Publication (4):
The ATM Forum Technical Committee. Private Network--Network Interface Specification Version 1.0 (PNNI 1.0). Mar. 1996.

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw De

☐ 2. Document ID: US 6724724 B1

L8: Entry 2 of 15 File: USPT Apr 20, 2004

DOCUMENT-IDENTIFIER: US 6724724 B1
**** See image for Certificate of Correction ****
TITLE: System and method for resolving an electronic address

h e b b g e e e f e bch ef b e

Brief Summary Text (9):
Each router 18, 22 typically maintains a table of address translations, such as the translation of device 22's X.25 address to device 22's TCP/IP address. These addresses are typically hard coded into the routers 18-20. Accordingly, if an address for a device changes, then each router 18-20 that includes that device's address will typically need to be accessed and the address will have to be changed. Since it is fairly common for a network to have its address scheme changed, it may be substantially time consuming to ensure that each router that contained each of the changed addresses is accessed and updated. Additionally, the process of individually changing an address in all the routers that maintain that address may be error prone.

Detailed Description Text (20):
If no translation is required, then device B is directly contacted (step 206). If, however, the route to device B does require translation, then a name resolution service, such as a domain name server (DNS) is contacted (step 208). The DNS which is contacted by the router may be a DNS local to the router, or a specific DNS identified in the router's routing table that contains the information to facilitate the address translation. Accordingly, only a relatively small number of DNSs would require updates of changes of addresses in order to dynamically affect all routers requesting that address.

Detailed Description Text (21):
Router C passes the protocol specific address, such as the X.25 address, to the DNS (step 210). The DNS then looks up its database for an address translation of the protocol specific address (step 212). For example, the DNS may look up its database for an address translation of an X.25 address to an associated TCP/IP address. Normally, a DNS is typically used to resolve a host name to a TCP/IP address. For example, a host name such as www.cisco.com may be resolved by a DNS to a TCP/IP address such as 192.21.23.45. This resolution is typically performed by looking up a table in the DNS that associates the host name to a TCP/IP address. In this embodiment of the invention, the DNS is used to translate one protocol specific address to another protocol specific address by replacing the host name information with a protocol specific address. Accordingly, a protocol specific address, such as an X.25 address, may be translated to a TCP/IP address. Additionally, the IP address portion of the table may also be substituted by another protocol specific address, such as an ATM address.

Current US Cross Reference Classification (3):
709/230

Other Reference Publication (3):
Dillon, Kevin, "PNNI: Effortless Expansion for ATM Networks", Dialog (R) File 647, ATM Forum Bay Networks, Nov. 7, 1998.

CLAIMS:

3\. The method of claim 2, further comprising: updating the table in the name resolution service element such that one or more addresses stored in the table may be resolved into a selected one of the first and second protocols.

11\. The medium of claim 10, further operable to: update the table in the name resolution service element such that one or more addresses stored in the table may be resolved into a selected one of the first and second protocols.

16\. The computer device of claim 15, wherein the table in the name resolution service element is updated such that one or more addresses stored in the table may be resolved into a selected one of the first and second protocols.

22\. The apparatus claim 20, wherein the table in the name resolution service

element is updated such that one or more addresses stored in the table may be resolved into a selected one of the first and second protocols.

☐ 3. Document ID: US 6643289 B1

L8: Entry 3 of 15 File: USPT Nov 4, 2003

DOCUMENT-IDENTIFIER: US 6643289 B1
TITLE: Method of MPOA status change notification

Detailed Description Text (41):
An MPS or MPC that receives the targetless LE_ARP message with or without a standard MPOA identification TLV, functions normally as defined in the ATM Forum MPOA standard as described above with respect to the LEC ATM address, the MAC address and the MPOA identification TLV association (step 92). A LEC receiving such a frame, operates the same as defined in the standard, whereby the MAC to ATM binding entry is updated to reflect the MPOA identification TLV. Note that in cases where more than one entry corresponds to an ATM address, all entries are updated.

Current US Cross Reference Classification (1):
709/223

Other Reference Publication (2):
Przygienda Proxy PNNI augmented routing. ATM, 1998, ICATM-98, 1998 1st IEEE International Conference, pp. 371-377.*

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw De

☐ 4. Document ID: US 6639901 B1

L8: Entry 4 of 15 File: USPT Oct 28, 2003

DOCUMENT-IDENTIFIER: US 6639901 B1
TITLE: Apparatus for and method for supporting 802.1Q VLAN tagging with independent VLAN learning in LAN emulation networks

Brief Summary Text (9):
The current standard solution for routing in a private ATM network is described in Private Network Node Interface (PNNI) Phase 0 and Phase 1 specifications published by the ATM Forum. The previous Phase 0 draft specification is referred to as Interim Inter-Switch Signaling Protocol (USP). The goal of the PNNI specifications is to provide customers of ATM network equipment some level of multi-vendor interoperability.

Brief Summary Text (67):

The learning process observes the source MAC addresses of frames received on each port and updates the filtering database accordingly. The VID of the frame is used to ensure that the address information is learnt relative to the VLAN of the frame. The learning process is able to determine the port through which particular end stations in the bridged LAN can be reached by inspection of the source MAC address field and VID of received frames: It records this information in the filtering database.

Detailed Description Paragraph Table (1):
DETAILED DESCRIPTION OF THE INVENTION Notation Used Throughout The following notation is used throughout this document. Term Definition AAL ATM Adaptation Layer ANSI American National Standards Institute ARP Address resolution Protocol ATM Asynchronous Transfer Mode BUS Broadcast and Unknown Server CCITT Comite Consulatif International Telegraphique et Telephonique DA Destination Address DDVC Data Direct Virtual Connection ELAN Emulated Local Area Network FCS Frame Check Sequence FDB Filtering Database FDDI Fiber Distributed Data Interface FID Filtering identifier IISP Interim Inter-Switch Signaling Protocol IP Internet Protocol IPX Internetwork Packet Exchange ITU International Telecommunications Union IVL Independent VLAN Learning LAN Local Area Network LANE LAN Emulation LE LAN Emulation LEC LAN Emulation Client LECS LAN Emulation Configuration Server LES LAN Emulation Server LNNI LAN Emulation Network to Network Interface LUNI LAN Emulation User to Network Interface MAC Media Access Control MMAC Multicast Media Access Control OUI Organizational Unit Identifier P2M Point-to-Multipoint P2P Point-to-Point PDU Protocol Data Unit PNNI Private Network to Network Interface PVC Permanent Virtual Circuit PVID Port VLAN Identifier SA Source Address SAR Segmentation and Reassembly SCSP Server Cache Synchronization Protocol SMS Selective Multicast Server SVC Switched Virtual Circuit SVL Shared VLAN Learning TCI Tag Control Information TLV Type, Length, Value TPID Tag Protocol Identifier UNI User to Network Interface VCC Virtual Channel Connection VCI Virtual Circuit Identifier VID VLAN Identifier VLAN Virtual Local Area Network VPI Virtual Path Identifier Definitions Used Throughout The following definitions are used throughout this document. Term Definition Frame A unit of data transmission on an IEEE 802 LAN MAC that conveys a Protocol Data Unit (PDU) between MAC Service users. There are three types of frame: Untagged, VLAN-Tagged and Priority-Tagged. IVL Configuration and operation of the Learning Process and the Filtering Database such that, for a given set of VLANs, if a given individual MAC address is learnt in one VLAN, that learnt information is not used in forwarding decisions taken for that address relative to any other VLAN in the given set. SVL Configuration and operation of the Learning Process and the Filtering Database such that, for a given set of VLANs, if an individual MAC address is learnt in one VLAN, that learnt information is used in forwarding decisions taken for that address relative to all other VLANs in the given set. Tag A Tag Header allows user priority information, and Header optionally, VLAN identification information, to be associated with a frame. Tagged A frame that contains a Tag Header immediately following Frame the Source MAC address field of the frame. Untagged A frame that does not contain a Tag Header immediately Frame following the Source MAC address field of the frame. VLAN A subset of the active topology of a Bridged Local Area Network. Associated with each VLAN is a VLAN Identifier (VID). VLAN- A property of Bridges or end stations that recognize aware and support VLAN-Tagged Frames. VLAN- A property of Bridges or end stations that do not recognize unaware VLAN-Tagged Frames.

Current US Cross Reference Classification (4):
709/238

☐ 5. Document ID: US 6606303 B1

L8: Entry 5 of 15 File: USPT Aug 12, 2003

DOCUMENT-IDENTIFIER: US 6606303 B1
TITLE: Method and device in a packet switched network

Brief Summary Text (6):
In a private Asynchronous Transfer Mode (ATM) network the PNNI function, as specified by the ATM Forum will probably become the chosen function for resource management with respect to routing and signalling, and other functions. A part of the PNNI is a so called dynamic routing protocol meaning that a node in the network will announce and update information regarding its own identity, the resources on its outgoing links and in the node, and address reachability, to all neighboring nodes. This way, in the end all nodes in the network will have a complete hierarchical view of the topology of the network, including its available resources.

Brief Summary Text (7):
The PNNI protocol is defined for use between private ATM switches and between private ATM networks. The abbreviation PNNI stands for either Private Network Node Interface or Private Network-to-Network Interface, reflecting these two areas of use. PNNI routing is used in a private network of ATM switching systems. PNNI includes a routing protocol for distribution of topology information between switches and groups of switches. The functions of the PNNI routing protocol include, among other things: discovery of neighbours and link and node status, synchronization of topology databases, construction of the routing hierarchy, transmission of PNNI topology state elements from each node to all other nodes.

Brief Summary Text (11):
To avoid the problems of hop-by-hop routing PNNI uses source routing for all connection setup requests. The first node in a peer group selects the entire path across that peer group and across all other peer groups for the purpose of reaching the destination. The path is encoded as a set of Designated Transit Lists (DTLs) explicitly included in the connection setup request. The DTLs specify every node used in transit across the peer group and may also specify the logical links to be used between the nodes. If a node along the path is unable to follow the DTL for a specific connection setup request the node must perform a so called crankback, that is, return the connection setup request to the node in which the DTL was created.

Brief Summary Text (18):
Routing for connections with multiple performance constraints complicates the problem in two ways. First, each link must be described in terms of multiple parameters. Second, the ability of a link to participate in a path depends on the requirements of the connection being routed. Having fill topology information and status about actual network resources and capacity is necessary to be able to compare different link costs with each other in order to build least-cost routes to every other destination in the network. The PNNI distributes complete routing information to all nodes, making it desirable to use Dijkstra's algorithm, which, however can only optimize on one parameter. For example, the path for which the delay is minimized may very well have an unacceptably low bandwidth or high delay variation, or vice versa.

Brief Summary Text (30):
The parameters used comprise the maximum cell transfer delay (CTD), the peak-to-peak Cell Delay Variation (CDV), the Available Cell Rate (AvCR), the Maximum Cell Rate (MCR) and the Cell Loss Ratio (CLR). An Administrative Weight (AW) may also be

included. These parameters are specified in the PNNI routing specification, agreed by the ATM Forum, and will be explained in somewhat more detail below.

Brief Summary Text (36):
The routing with respect to multiple constraints in a PNNI network environment specifically addressing the traffic contracts of the rt-VBR service categories is enabled.

Drawing Description Text (2):
FIG. 1 shows schematically a packet switch network with two hierarchical levels according to the PNNI protocol.

Detailed Description Text (2):
FIG. 1 is a schematic representation of a packet switch network comprising a number of logical nodes and with two hierarchical levels. The lowest level of the PNNI hierarchy comprises the logical nodes that are organized into peer groups. The nodes in a peer group exchange information with the other nodes in the group, so that all nodes in the group have an identical view of the group and of other peer groups. Each logical node sees all nodes in its own peer group, but sees every other peer group only as a single node.

Detailed Description Text (11):
In PNNI, links are advertised unidirectionally, in the outgoing direction, but connections are always bidirectional, both directions using the same route. Therefore, the associated total link cost of a bidirectional link takes the network resources allocated both directions into consideration when computing the link cost.

Detailed Description Text (39):
A routing table is updated when the available resources of a node or link is changed or when the address reachability in the network is changed.

Current US Cross Reference Classification (2):
709/241

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw. De

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☐ 6. Document ID: US 6523696 B1

L8: Entry 6 of 15 File: USPT Feb 25, 2003

DOCUMENT-IDENTIFIER: US 6523696 B1
TITLE: Communication control device for realizing uniform service providing environment

Detailed Description Text (54):
Note that, in this embodiment, it is assumed that the AV control terminals 2 and 5 carry out communications with each other by using the IP, but it is also possible to realize this feature by using the other network layer technology (such as Netware, CLNP (Connection-Less Network Protocol), etc.) or the other technology (such as I-PNNI (Integrated P-NNI, 1394 protocol, etc.) instead of the IP.

Detailed Description Text (55):
Also, in this embodiment, the set up of the connection (channel) between the AV control terminals 2 and 5 is made by using the protocol called FANP, but it is

easily possible to realize this feature by using the other connection set up protocol such as RSVP (Resource Reservation Setup Protocol), ST2 (Stream Transport Protocol-2), or I-PNNI, instead of the FANP.

Detailed Description Text (280):
Namely, the AV connection device 2201 checks that it is the destination of the received IP packet by referring to the destination address of the received IP packet (step S5201), and then carries out the packet filtering processing by referring to the packet filter table 2209 (step S5202). When the source address of this packet is registered in the packet filter table 2209, whether a set of the destination IP address and the destination port number of this packet is registered in the address and port number conversion table 2207 or not is checked (step S5203). If it is registered, these destination IP address and destination port number are replaced by the corresponding IP address (private IP address) and first port number of the home network side (step S5204), and this IP packet is transmitted to the home network 2010 (step S5205). In this manner, the address conversion from the global IP address and the second port number to the private address and the first port number is carried out.

Detailed Description Text (284):
Namely, the AV connection device 2201 checks whether a set of the source IP address and the source port number of the received IP packet is registered in the address and port number conversion table 2207 or not (step S5301 and S5302). If it is registered, these source IP address and source port number are replaced by the corresponding IP address (global unique IP address) and second port number of Internet side (step S5303), and this IP packet is transmitted to Internet 2101 side (step S5304).

Current US Original Classification (1):
709/223

Current US Cross Reference Classification (1):
709/236

☐ 7. Document ID: US 6243384 B1

L8: Entry 7 of 15 File: USPT Jun 5, 2001

DOCUMENT-IDENTIFIER: US 6243384 B1
TITLE: Address analysis for asynchronous transfer mode node with PNNI protocol

Abstract Text (1):
An ATM switching node (20) which implements PNNI protocol has a table (known as the consolidated table) which stores plural records, each record associating a connection request input field with corresponding routing information. The node has table maintenance logic (78) which updates the table to consolidate therein both records initiated by operator input and records developed from PNNI updating information. The PNNI updating information is generated by a PNNI protocol unit (56) which consults a topology database of the node. Provision of the consolidate table obviates consultation of multiple tables.

Brief Summary Text (8):
A particular protocol, known as "PNNI", has been developed for use between private

ATM switches, and between groups of private ATM switches. Consistent with these two potential employments, "PNNI" stands for either Private Network Node Interface, or Private Network-to-Network Interface. Thus, PNNI is a routing information protocol that enables multi-vendor ATM switches to be integrated in the same network. The PNNI protocol is defined e.g., by The ATM Forum's Private Network.sub.-- Network Interface Specification Version 1.0 (PNNI 1.0), af-pnni-0055.000 (March 1996).

Brief Summary Text (9):
Each private ATM switch can be referred to as a (lowest level) node, each node having particular identifiers. Two nodes are connected together by a physical link, and many such nodes may be connected together. In PNNI parlance, nodes can be grouped together to form "peer groups". Each node exchanges certain identifying packets (e.g., "Hello" packets) with its immediate neighbors, so that each node can determine certain state information. The state information includes the identity and peer group membership of the node's immediate neighbors, and the status of the node's links to its neighbors. Each node uses the state information to prepare "PNNI Topology State Elements" (PTSEs) [henceforth also referred to as "topology messages"]. Nodes belonging to the same peer group exchange information with one another in a process known as "flooding", so that all nodes of the peer group have an identical view of the peer group.

Brief Summary Text (10):
Using the topology messages that it receives, each node builds its own topology database. The topology database essentially constitutes the node's view of the universe, e.g., the other nodes in its peer group, connections to other peer groups, and connections to private and public networks. Topology messages are sent in reoccurring fashion from each node, so that on the basis of PNNI information the topology database of each node is frequently updated by the relatively automatic flooding of topology messages. U.S. Pat. No. 4,920,529 to Sasaki et al. discloses e.g., a mode of reconfiguring databases wherein network reconfiguration information is switched from a preparatory side to an operating side for usage.

Brief Summary Text (12):
The topology database of a node is important in view of the fact that PNNI uses source routing for all connection setup requests. In this regard, when a user requests a connection setup, an originating node (i.e., the first switching node encountered) chooses a general path to the destination, the general path being specified in accordance with the detail of the hierarchy known to the originating node. The path can be chosen using a path selection algorithm, which may vary from node to node. The path selection algorithm uses the information stored in the topology database in order to choose the general path to the destination, as well as other factors such as the connection's service category, traffic characteristics, and quality of services requirements, for example. The path is encoded as a Designated Transit List (DTL), which is included in the connection setup request. The path specifies every node to be used in transit across the peer group to which the originating node belongs, and refers to higher level nodes which are to be used in reaching the destination. When the connection setup request reaches another node level, e.g., another peer group, the ingress node of the newly reached peer group selects the particular path across the newly reached peer group, consistent with the general path chosen by the originating node (unless a problem occurs).

Brief Summary Text (15):
An ATM switching node which implements PNNI protocol has a table (known as the consolidated table) which stores plural records, each record associating a connection request input field with corresponding routing information. The node has table maintenance logic which updates the table to consolidate therein both records initiated by operator input and records developed from PNNI updating information. The PNNI updating information is generated by a PNNI protocol unit which consults a topology database of the node. Provision of the consolidate table obviates

consultation of multiple tables.

Brief Summary Text (18):
The node also includes a static table in which operator input information is stored for use in developing the records initiated by operator input. The operator input information stored in the static table and the PNNI updating information are merged in the inactive version of the consolidated table during table updating.

Drawing Description Text (14):
FIG. 8 is a diagrammatic view depicting messages involved the PNNI protocol updating of a consolidated table.

Drawing Description Text (15):
FIG. 8A is a flowchart showing actions taken by table maintenance logic in connection with the PNNI protocol updating of a consolidated table.

Detailed Description Text (3):
FIG. 1 shows an ATM switching node 20 according to an embodiment of the invention and which employs PNNI protocol. ATM switching node 20 includes a switch fabric or switch core 22 having core ports 24.sub.0 -24.sub.n which receive ATM cells, and core ports 26.sub.0 -26.sub.n from which ATM cells leave switch core 22. In the illustrated embodiment, ports 24.sub.1 -24.sub.n are connected by physical links 34.sub.1 -34.sub.n to other ATM nodes; ports 26.sub.1 -26.sub.n are connected by physical links 36.sub.1 -36.sub.n to other ATM nodes. Although not shown, it should be understood that one or more circuit boards may be connected between a core port and a physical link for various purposes, for example the handling ingress or egress ATM cells as the case may be, particularly for buffering and conversion between external and switch-internal VPI/VCI assignments.

Detailed Description Text (4):
In addition to switch core 22, ATM switching node 20 includes a node control system 40 which supervises operation of ATM switching node 20 and which performs PNNI-related operations including source routing. In the particular embodiment shown in FIG. 1, node control system 40 is situated on a circuit board which is connected to send ATM cells via physical link 34.sub.0 to switch core 22 (i.e., to core port 24.sub.0) and to obtain ATM cells from switch core 22 (i.e., core port 26.sub.0) via physical link 36.sub.0. Although shown as occupying only one board in the illustrated embodiment, it should be understood that in other embodiments the functions of node control system 40 can be distributed as desired among plural circuit boards and therefore addressable through plural ports of switch core 22.

Detailed Description Text (10):
In contrast to the static data maintained in static table 90, address and routing data can also be dynamically provided to table handling unit 60 in view of the PNNI protocol implemented by ATM switching node 20. In this regard, topology cell handling unit 52 recurrently receives topology messages (e.g., PTSEs) in the form of ATM cells from other nodes in the same peer group with ATM switching node 20. The topology cell handling unit 52 builds the topology database of ATM switching node 20. The routing determination unit 56, which functions as the PNNI protocol unit (PNNIR) implements the node's path selection algorithm based on the information stored in the topology database. Routes or paths determined by the path selection algorithm of routing determination unit 56 are forwarded to table maintenance logic 78 of table handling processor 70 for use in an appropriate results field of routing analysis section 84 of the consolidated table 80.

Detailed Description Text (17):
FIG. 4A together with FIG. 4B show a second traffic case in which node 20 is involved in connection setup for a connection from the user having address 7192345 (connected by UNI 11 to node 20) to a user in private network 120 having address 5575956. FIG. 4B shows a connection request message 4B-1 from user having address

7192345 to node 20, the connection request message 4B-1 including the called party number (e.g., address 5575956) of the called party. Upon receipt of the connection request message 4B-1, call control unit 54 sends the address 5575956 to address analysis logic 72 of table handling processor 70. The address analysis logic 72 locates in address analysis section 82 of the active consolidated table a record which has the address 55 as an input value. As shown in the example table of FIG. 2, the second record of address analysis section 82 has such value, along with a paired result value of "RC-1". The result value "RC-1" indicative of a routing case is returned by address analysis logic 72 to call control unit 54 as indicated by message 4B-2. Upon receipt of the routing case result value "RC-1", call control unit 54 sends message 4B-3 (including the result value "RC-1") to routing logic 74. The routing logic 74 consults routing analysis section 84 of table 80 (see FIG. 2), and using RC-1 as an index returns a list of routes message 4B-4. The list of routes message 4B-4 includes the three routes or paths garnered from the second record of routing analysis section 84 of table 80, i.e., UNIRoute 1; PNNIA.1.3; and PNNIA.2. The first such route (UNIRoute 1) is over interface UNI 13 which connects node 20 to private network 120. The second route (PNNIA.1.3) is through node A.1.3 and a UNI connecting node A.1.3 to private network 120. The third route (PNNIA.2) is through peer group A.2 (via node A.1.3) and over a UNI connecting peer group A.2 to private network 120. the order of the routes/paths in the list of routes messages is indicative of the priority or preference. The particular priority specified in the results field is a result of operator input, since the priority between PNNI and UNI/BICI is set by the operator. The ultimate choice regarding priority is up to call control unit 54. Regardless of such choice, the traffic case of FIG. 4A is thus seen as being from an originating UNI to an outgoing UNI.

Detailed Description Text (21):
The table maintenance logic 78 of table handling unit 60 of the present invention provides for the consolidated active table 80, and allows for the table to be updated in two different ways. As diagrammatically depicted in FIG. 7, the table maintenance logic 78 of table handling unit 60 can receive updating input both from an operator (e.g., via workstation 98) and from the network via the PNNI protocol (e.g., in the form of a signal pnni_info from routing determination unit 56 [PNNIR]). As shown in FIG. 7, the operator's updating input is stored by table maintenance logic 78 in static table 90, while the PNNI updating input is stored by table maintenance logic 78 in inactive table 80B. Advantageously, table maintenance logic 78 merges the operator's updating input stored in static table 90 into inactive table 80B as indicated by arrow M. After the merging operation, the table containing the merging results (table 80B) is linked in to become the active table (table 80A), as represented by arrow L in FIG. 7.

Detailed Description Text (22):
As depicted in FIG. 7, via table maintenance logic 78 the operator can update one or more sections of static table 90, i.e., address analysis section 92, routing analysis section 94, or local look-up section 96. The static table 90 is then merged by table maintenance logic 78 with an inactive one of the consolidated tables (i.e., a copy of the active consolidated table maintained on a non-operational side of table handling unit 60).

Detailed Description Text (23):
When table maintenance logic 78 updates the address analysis section 82 of the active table 80A, a copy of the active table 80A is made on the non-operational side, e.g., inactive table 80B. Since the routing determination unit 56 [PNNIR] typically routinely obtains PNNI information about existing nodes in the network, table maintenance logic 78 uses such PNNI information to update the address analysis section 82 of inactive table 80B. Alternatively or additionally, address analysis section 82 can be updated when updating input is received from an operator and first stored in address analysis section 92, followed by merger of the data from address analysis section 92 into the address analysis section 82 of the inactive table 80B. The operator preferably specifies the address in ATM end system

format, which is described in ATM User-Network Interface (UNI) Signalling Specification Version 4.0. By either updating mode (operator or PNNI), when a routing case is provided as a result, a verification is made by table maintenance logic 78 that the routing case is defined in routing analysis section 84.

Detailed Description Text (24):
The routing analysis section 84 of the active table can also be updated. As in the case of updating the address analysis section 82, a copy is made of the active table to form the inactive table 80B. The routing analysis section 84 is updated by the operator, with the updating information first stored in routing analysis section 94 of static table 90 and then merged with routing analysis section 84 of the inactive table 80B. Then, after merger, the updated information is included in the active table 80A. An operator is not allowed to remove a routing case that is used in address analysis section 82. Moreover, when a routing case is defined by the operator, a check is made by BICI/UNI to ensure that the route is defined.

Detailed Description Text (25):
FIG. 8 together with FIG. 8A show updating of the active table 80A accomplished by the PNNI protocol, e.g., PNNI updating. FIG. 8A shows basic steps performed by table maintenance logic 78 upon receipt of the PNNI updating information indicated by message 8-1 (pnni_info) in FIG. 8. In FIG. 8, "ANA" refers to table handling unit 60; and "PNNIR" refers to routing determination unit 56. PNNI updating begins when table maintenance logic 78 receives PNNI updating information from routing determination unit 56 [PNNIR], as indicated by message 8-1 (pnni_info) in FIG. 8.

Detailed Description Text (26):
In particular, step 8A-1 shows table maintenance logic 78 receiving the PNNI updating information from routing determination unit (PNNIR) 56. The PNNI data obtained at step 8A-1 is in the form of a list which is included in the pnni_info signal, which signal contains all addresses that have been flooded out and the nodes to which they are connected. At step 8A-2, an inactive table 80B (see FIG. 11) is prepared on a non-operational side of table handling unit 60 by copying the current active table 80A. The active table 80A is on an operational side of table handling unit 60. As step 8A-3, all data in static table 90 is obtained by table maintenance logic 78 for and copied into the inactive table 80B.

Detailed Description Text (27):
At step 8A-4 The list of data received from PNNI at step 8A-1 is divided into one element for each address, i.e., one entry for each address. For example, for address "55" the element {55, A.1.3, A2} is prepared, the element having the values A.1.3 and A2 for its results field (see FIG. 2). Other comparable elements similarly understood with respect to FIG. 2 include {727, A.1.2, A2} and {400,A2}.

Detailed Description Text (28):
Step 8A-5 begins a loop, with step 8A-5 being an attempt to store the PNNI addresses and corresponding results fields in the inactive table 80B. The attempt of step 8A-5 may be determined at step 8A-6 to be unsuccessful because, for example, an entry may already exist in inactive table 80B corresponding to the information sought to be stored. If an entry already exists in inactive table 80B, at step 8A-7 the stored static data is merged with PNNI data for that entry, with the merged result being used as replacement for the corresponding entry in the inactive table 80B. If an entry does not yet exist, then at step 8A-8 a new entry is created in the inactive table 80B. Step 8A-5 is repeated for every address for which the PNNI has updating information, e.g., until all PNNI updates are processed as indicated by step 8A-9.

Detailed Description Text (29):
After all PNNI updates have been processed, at step 8A-10 the table maintenance logic 78 essentially switches tables by putting the inactive table 80B on the operational side and removing formerly active table 80A to the non-operational side

(see FIG. 11). In other words, the table selector S in FIG. 1 is switched, and table 80B is linked to become the active table (see FIG. 7). Upon completion of PNNI updating, a signal 8-2 is sent from table handling unit 60 to routing determination unit 56 to confirm completion of the PNNI updating.

Detailed Description Text (30):
The foregoing discussion, with particular reference to FIG. 8 and FIG. 8A, describes the relative automatic PNNI updating. By contrast, FIG. 9 shows a procedure for an operator to update active table 80. In FIG. 9, "AnaMI" refers to an interface with the operator; "ANA" refers to table handling unit 60; and "PNNI" refers to the PNNI protocol implemented in routing determination unit 56 of ATM switching node 20.

Detailed Description Text (33):
Assuming that PNNI updates as described in FIG. 8 and FIG. 8A are also possible, table maintenance logic 78 requests PNNI data from routing determination unit 56 [PNNIR] by sending a poll-address message shown as message 9-8 in FIG. 9. In response to the poll-address message, routing determination unit 56 sends the pnni-info signal shown as message 9-9 in FIG. 9. The PNNI information is received by table maintenance logic 78. Then, the steps of FIG. 8A are performed by table maintenance logic 78, resulting in the merging of data from static table 90 with the PNNI data obtained from PNNIR.

Detailed Description Text (37):
Advantageously, in the present invention only one table--the active table 80--need be searched when table handling unit 60 is forwarded a called party number or address by call control unit 54 in connection with connection setup. The table 80 which is used as the active table is updated by both the operator (e.g., via workstation 98) and by the network (e.g., via the PSTEs of the PNNI protocol).

Current US Cross Reference Classification (3):
709/238

Other Reference Publication (5):
The ATM Forum Technical Committee, Private Network-Network Interface Specification Version 1.0 (PNNI 1.0), af-pnni-0055.000, Mar. 1996.

Other Reference Publication (6):
The ATM Forum Slide Presentation, Complete Long-Term Solution: PNNI Phase 1, ATM PNNImod 1.0-9 A, 1996.

CLAIMS:

1. An ATM switching node which implements PNNI protocol, the node comprising:

a PNNI protocol unit which uses a topology database to prepare PNNI updating information;

a table which stores plural records, each record associating a connection request input field with corresponding routing information, wherein the table has an active version and an inactive version copied therefrom, wherein the active version of the table is utilized in connection setup;

table maintenance logic which updates the table to consolidate therein both records initiated by operator input and records developed from the network signaling updating information; wherein updating is performed on the inactive version of the table, and wherein when updating is completed the inactive version of the table becomes the active version of the table.

4. The apparatus of claim 1, further comprising:

h e b b g e e e f e bch ef b e

a static table in which operator input information is stored for use in developing the records initiated by operator input; and

wherein the operator input information stored in the static table and the PNNI updating information are merged in the inactive version of the table.

7. A method of operating an ATM switching node which implements PNNI protocol, the method comprising:

receiving topology messages and building a topology database for the node;

using the topology database to prepare PNNI updating information;

consulting a table to obtain routing information associated with a corresponding connection request input field, the table having an active version and an inactive version copied therefrom;

using the active version of the table in connection setup;

updating the inactive version of the table by consolidating operator input information and the PNNI updating information; and

when updating is completed, using the inactive version of the table as the active version of the table.

9. The method of claim 7, further comprising:

storing the operator input information in a static table; and

merging the operator input information stored in the static table and the PNNI updating information in the inactive version of the table.

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw De

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☐ 8. Document ID: US 6208623 B1

L8: Entry 8 of 15 File: USPT Mar 27, 2001

DOCUMENT-IDENTIFIER: US 6208623 B1
TITLE: Method of combining PNNI and E-IISP in an asynchronous transfer mode network

Abstract Text (1):
A method of permitting older networks based on E-IISP routing to operate in newer PNNI based networks. The invention combines the PNNI and E-IISP routing schemes and permits their simultaneous execution in the same ATM network. The E-IISP routing scheme is modified so as to operate in unison with the minimal PNNI implementation configured on each node. The Hello protocol and associated Finite State Machine (FSM) are utilized to determine whether a remote node is in the same peer group. If it is determined that both nodes are in the same peer group, the ports on either side of the link are configured as standard PNNI type ports. If it is determined that the two nodes are from different peer groups, the ports on either of the link are configured as E-IISP type ports. Foreign address information is then exchanged

between the two nodes thus permitting border nodes to learn about other peer groups from their respective remote nodes. Relatively large networks can be constructed that do not have any hierarchy as in networks running the full PNNI standard. Via the Hello protocol, changes made to links between nodes will be detected immediately and the port configuration modified appropriately.

Brief Summary Text (9):
The current standard solution for routing in a private ATM network is described in Private Network Node Interface (PNNI) Phase 0 and Phase 1 specifications published by the ATM Forum. The previous Phase 0 draft specification is referred to as Interim Inter-Switch Signaling Protocol (IISP). The goal of the PNNI specifications is to provide customers of ATM network equipment some level of multi-vendor interoperability.

Brief Summary Text (10):
The Interim Local Management Interface (ILMI) for the PNNI protocol specification provides an auto-port configuration capability. This capability functions to minimize manual configuration operations for PNNI ports of switches. The Phase 0 solution to auto-port configuration is based on hop by hop routing utilizing a `best match` scheme. The Phase 1 PNNI based solution is based on Open Shortest Path First (OSPF) with the additions necessary for ATM. This scheme is essentially a `source routing` scheme whereby each node has basic knowledge of the structure of the entire network and uses this knowledge to build a complete path from the source to the destination. When a connection is to be set up from a source to a destination, the source sends out a SETUP message that has within it the address of the destination. Each ATM network node along the way reads the next node from the SETUP message and forwards the message to an appropriate next node. This continues until the SETUP message arrives at its destination.

Brief Summary Text (14):
PNNI Phase 1

Brief Summary Text (15):
As part of the ongoing enhancement to the ATM standard by work within the ATM Forum and other groups, the Private Network to Network Interface (PNNI) protocol Phase 1 has been developed for use between private ATM switches and between groups of private ATM switches. The PNNI specification includes two categories of protocols. The first protocol is defined for the distribution of topology information between switches and clusters of switches where the information is used to compute routing paths within the network. The main feature of the PNNI hierarchy mechanism is its ability to automatically configure itself within the networks in which the address structure reflects the topology. The PNNI topology and routing techniques are based on the well known link state routing technique.

Brief Summary Text (17):
With reference to the PNNI Phase 1 specifications, the PNNI hierarchy begins at the lowest level where the lowest level nodes are organized into peer groups. A logical node in the context of the lowest hierarchy level is the lowest level node. A logical node is typically denoted as simply a node. A peer group is a collection of logical nodes wherein each node within the group exchanges information with the other members of the group such that all members maintain an identical view of the group. When a logical length becomes operational, the nodes attached to it initiate and exchange information via a well known Virtual Channel Connection (VCC) used as a PNNI Routing Control Channel (RCC).

Brief Summary Text (18):
Hello messages are sent periodically by each node on this link. In this fashion the Hello protocol makes the two neighboring nodes known to each other. Each node exchanges Hello packets with its immediate neighbors to determine its neighbor's local state information. The state information includes the identity and peer group

membership of the node's immediate neighbors and the status of its links to its neighbors. Each node then bundles its state information in one or more PNNI Topology State Elements (PTSEs) which are subsequently flooded throughout the peer group.

Def. PTSE

Brief Summary Text (19):
PTSEs are the smallest collection of PNNI routing information that is flooded as a unit among all logical nodes within a peer group. A node topology database consists of a collection of all PTSEs received, which represent that particular node's present view of the PNNI routing topology. In particular, the topology database provides all the information required to compute a route from the given source node to any destination address reachable in or through that routing domain.

Brief Summary Text (20):
When neighboring nodes at either end of a logical length begin initializing through the exchange of Hellos, they may conclude that they are in the same peer group. If it is concluded that they are in the same peer group, they proceed to synchronize their topology databases. Database synchronization includes the exchange of information between neighboring nodes resulting in the two nodes having identical topology databases. A topology database includes detailed topology information about the peer group in which the logical node resides in addition to more abstract topology information representing the remainder of the PNNI routing domain.

Brief Summary Text (21):
During a topology database synchronization, the nodes in question first exchange PTSE header information, i.e., they advertise the presence of PTSEs in their respective topology databases. When a node receives PTSE header information that advertises a more recent PTSE version than the one that it has already or advertises a PTSE that it does not yet have, it requests the advertised PTSE and updates its topology database with the subsequently received PTSE. If the newly initialized node connects to a peer group then the ensuing database synchronization reduces to a one way topology database copy. A link is advertised by a PTSE transmission only after the database synchronization between the respective neighboring nodes has successfully completed. In this fashion, the link state parameters are distributed to all topology databases in the peer group.

Brief Summary Text (22):
Flooding is the mechanism used for advertising links whereby PTSEs are reliably propagated node by node throughout a peer group. Flooding ensures that all nodes in a peer group maintain identical topology databases. A short description of the flooding procedure follows. PTSEs are encapsulated within PNNI Topology State Packets (PTSPs) for transmission. When a PTSP is received its component PTSEs are examined. Each PTSE is acknowledged by encapsulating information from its PTSE header within the acknowledgment packet which is sent back to the sending neighbor. If the PTSE is new or of more recent origin then the node's current copy, the PTSE is installed in the topology database and flooded to all neighboring nodes except the one from which the PTSE was received. A PTSE sent to a neighbor is periodically retransmitted until acknowledged.

Brief Summary Text (23):
Note that flooding is an ongoing activity wherein each node issues PTSPs with PTSEs that contain updated information. The PTSEs contain the topology databases and are subject to aging and get removed after a predefined duration if they are not refreshed by a new incoming PTSE. Only the node that originally originated a particular PTSE can re-originate that PTSE. PTSEs are reissued both periodically and on an event driven basis.

Brief Summary Text (24):
As described previously, when a node first learns about the existence of a neighboring peer node which resides in the same peer group, it initiates the

database exchange process in order to synchronize its topology database with that of its neighbor's. The database exchange process involves exchanging a sequence of database summary packets which contain the identifying information of all PTSEs in a node topology database. The database summary packet performs an exchange utilizing a lock step mechanism whereby one side sends a database summary packet and the other side responds with its own database summary packet, thus acknowledging the received packet.

Brief Summary Text (25):
When a node receives a database summary packet from its neighboring peer, it first examines its topology database for the presence of each PTSE described within the packet. If the particular PTSE is not found in its topology database or if the neighboring peer has a more recent version of the PTSE then the node requests the PTSE from the particular neighboring peer or optionally from another neighboring peer whose database summary indicates that it has the most recent version of the PTSE.

Brief Summary Text (29):
After the peer processes the database summary packets, the missing or updated PTSEs can then be requested. In the Exchanging state the database summary packets contain summaries of the topology state information contained in the node's database. In the case of logical group nodes, those portions of the topology database that were originated or received at the level of the logical group node or at higher levels are included in the database summary. The PTSP and PTSE header information of each such PTSE is listed in one of the nodes database packets. PTSE's for which new instances are received after the exchanging state has been entered may not be included in any database summary packet since they will be handled by the normal flooding procedures.

Brief Summary Text (30):
The incoming data base summary packet on the receive side is associated with a neighboring peer via the interface over which it was received. Each database summary packet has a database summary sequence number that is implicitly acknowledged. For each PTSE listed, the node looks up the PTSE in its database to see whether it also has an instance of that particular PTSE. If it does not or if the database copy is less recent, then the node either re-originates the newer instance of the PTSE or flushes the PTSE from the routing domain after installing it in the topology database with a remaining lifetime set accordingly.

Brief Summary Text (31):
Alternatively, if the listed PTSE has expired, the PTSP and PTSE header contents in the PTSE summary are accepted as a newer or updated PTSE with empty contents. If the PTSE is not found in the node's topology database, the particular PTSE is put on the PTSE request list so it can be requested from a neighboring peer via one or more PTSE request packets.

Brief Summary Text (32):
If the PTSE request list from a node is empty, the database synchronization is considered complete and the node moves to the Full state.

Brief Summary Text (33):
However, if the PTSE request list is not empty then the Loading state is entered once the node's last database summary packet has been sent but the PTSE request list is not empty. At this point, the node now knows which PTSE needs to be requested. The PTSE request list contains a list of those PTSEs that need to be obtained in order to synchronize that particular node's topology database with the neighboring peer's topology database. To request these PTSEs, the node sends the PTSE request packet which contains one or more entries from the PTSE request list. The PTSE request list packets are only sent during the Exchanging state and the Loading state. The node can sent a PTSE request pack to a neighboring peer and

optionally to any other neighboring peers that are also in either the Exchanging state or the Loading state and whose database summary indicate that they have the missing PTSEs.

Brief Summary Text (34):
The received PTSE request packets specify a list of PTSEs that the neighboring peer wishes to receive. For each PTSE specified in the PTSE request packet, its instance is looked up in the node's topology database. The requested PTSEs are subsequently bundled into PTSPs and transmitted to the neighboring peer. Once the last PTSE and the PTSE request list has been received, the node moves from the Loading state to the Full state. Once the Full state has been reached, the node has received all PTSEs known to be available from its neighboring peer and links to the neighboring peer can now be advertised within PTSEs.

Brief Summary Text (39):
Thus, the automatic exchange of network address prefixes causes the routing tables of each node to be updated and permits the signaling to `come up`. This is in contrast to IISP Phase 0 which requires that link attributes to be set manually. This method is thus especially advantageous in large networks having more than two nodes.

Brief Summary Text (41):
Note that the above described PNNI and IISP routing schemes are inherently different. In PNNI, only full address matching is permitted, i.e., an address must fully match the address entry in the topology database. In contrast, IISP permits partial address matching. The IISP routing method is a partially static routing scheme.

Brief Summary Text (42):
In addition, there are many ATM switches currently in operation that support only the IISP type routing. It is desirable to permit the owners of many of these older ATM switches to upgrade their switches to the more modern PNNI type routing. Upgrades can be performed by upgrading the operating software within the switches. In order to permit upgraded nodes to operate in a PNNI network, the upgraded switches can only support a minimal PNNI configuration. This means that the hierarchical features of PNNI are not supported. More specifically, in a minimal subset of PNNI, a node cannot function as a border node or as a Peer Group Leader (PGL). A border node is a node that has a link to another peer group and executes a special finite state machine (FSM). The PGL is the node that represents the whole peer group and functions as the key component for building large hierarchical networks.

Brief Summary Text (43):
A conflict exists, however, since a major benefit of PNNI is its ability to permit network designers to construct large hierarchical networks. Using PNNI, networks can be constructed that comprise peer groups having from dozens to over a hundred nodes. The concept is that many nodes in the same peer group can be represented as one node in a higher level of the hierarchy. Since PNNI utilizes a link state, source routing type routing scheme wherein each node has a view of the entire network, it is the hierarchy that permits the division of the network view into smaller chunks. In PNNI, very large portions of the network comprising a large number of nodes may be viewed by nodes in other peer groups as a single logical node.

Brief Summary Text (44):
A limitation of the older ATM switches currently in use is that they cannot support large PNNI networks. If the nodes in a network only support a minimal PNNI implementation, large hierarchical networks cannot be constructed. Thus, all the nodes in such a network will be at the same peer level. This causes each node in the peer group to include the whole peer in its network topology database,

including nodal, link and addressing information.

Brief Summary Text (47):
The present invention provides a solution to permit older networks based on IISP routing to operate in newer PNNI based networks. The invention is a method which combines the PNNI routing scheme with an enhanced version of the IISP routing scheme which permits their simultaneous execution in the same ATM network. The IISP routing scheme is modified so as to operate in unison with the minimal PNNI implementation configured on each node. The modified IISP is termed enhanced IISP or E-IISP.

Brief Summary Text (48):
In the present invention, it is assumed that nodes are configured with a minimal PNNI implementation and they (1) cannot function as border nodes and (2) cannot function as peer group leaders.

Brief Summary Text (49):
The method of the present invention utilizes the Hello protocol and associated Finite State Machine (FSM) to determine whether a remote node is in the same peer group. The peer group IDs are exchanged and examined. The addresses and levels are exchanged via the Hello protocol. If it is determined that both nodes are in the same peer group, the ports on either side of the link are configured as standard PNNI type ports. The Hello protocol, associated FSM and PTSE FSM continue in accordance with the standard.

Brief Summary Text (51):
Thus, the nodes within a peer group are connected by links of the PNNI type and border nodes between peer groups are connected by links of the E-IISP type. Since each node eventually learns about the address prefixes of other peer groups in the network using ILMI in combination with the method of the present invention, a source user connected to a source node can be routed to a destination user connected to a destination node anywhere in the network.

Brief Summary Text (52):
In this fashion, relatively large networks can be constructed that do not have any hierarchy as in networks running the full PNNI standard as opposed to the minimal PNNI implementation. To prevent switches from exceeding their limited memory capacity, it is recommended that the number of nodes placed in each peer group be limited. For example, the number of nodes in a peer group can be limited to 50 so as not to exceed the memory capacity of the switches.

Brief Summary Text (53):
In addition, since the Hello protocol is always running, changes made to links between nodes will be detected immediately. In response to links being disconnected and reconnected to form different network configurations, a node may switch the port configuration type from PNNI to E-IISP and vice versa. When a port type is changed from E-IISP to PNNI, the locally registered addresses must be flushed from the topology database.

Brief Summary Text (54):
There is provided in accordance with the present invention, in an Asynchronous Transfer Mode (ATM) network having a plurality of nodes, the plurality of nodes configured to form one or more peer groups connected by one or more links, each node having a topology database and being capable of configuring each of its ports as either a Private Network Node Interface (PNNI) type port or an Enhanced Interim Inter-Switch Signaling Protocol (E-IISP) type port, a method of building ATM networks combining both PNNI and E-IISP schemes, the method comprising the steps of determining, on each node connected to a remote node via a link, whether the node and its remote node are from the same peer group, configuring the port associated with the link as a PNNI type port if the node and its remote node are from the same

peer group, configuring the port associated with the link as an E-IISP type port if the node and its remote node are not from the same peer group, transferring from the node to the remote node, all foreign addresses in the topology database of the node, registering the foreign addresses received by the remote node in the topology database of the remote node and flooding the foreign addresses from the remote node to other nodes that are members of the peer group of the remote node.

Brief Summary Text (55):
The step of determining comprises the steps of executing a Hello protocol and associated Finite State Machine (FSM) of PNNI on each port configured as a non User to Network Interface (UNI) port and extracting a peer group ID from Hello messages received from a remote node located on the other side of the link each port is connected to.

Brief Summary Text (56):
The method further comprises the step of executing a conventional Hello protocol and PNNI Topology State Element (PTSE) Finite State Machines (FSMs) of PNNI. The method further comprises the step of executing a conventional Hello protocol and PNNI Topology State Elements (PTSE) Finite State Machines (FSMs) of PNNI on each port regardless of whether the port is configured as a PNNI type port or an E-IISP type port. The method further comprises the step of changing the configuration of a port from a PNNI type port to an E-IISP type port in response to one or more changes to the configuration of the network. The method further comprises the step of changing the configuration of a port from an E-IISP type port to a PNNI type port in response to one or more changes to the configuration of the network. The method further comprises the step of transferring and registering the foreign addresses from the node to the remote node utilizing the Interim Local Management Interface (ILMI) protocol.

Drawing Description Text (3):
FIG. 1 is a diagram illustrating an example ATM network having three peers wherein all nodes are running a minimal PNNI implementation;

Detailed Description Text (5):
A diagram illustrating an example ATM network having three peers wherein all nodes are running a minimal PNNI implementation is shown in FIG. 1. The example network shown in FIG. 1 is presented for illustrative purposes only. ATM networks having an unlimited number of configurations are also within the scope of the present invention. In addition, to aid in the understanding principles of the present invention, the following description uses a PNNI level of 80 as an example. This in no way is meant to limit the scope of the present invention, as any PNNI level may be used with the invention. In addition, each link on each node is configured to be either a UNI port or a non-UNI port. Non-UNI ports may function either as a PNNI port or as an E-IISP port. It is thus assumed that each node in the network can configure its ports in accordance with the PNNI standard and in accordance with the E-IISP. Details of the PNNI protocol standard can be found in ATM Forum PNNI-1 Specification, incorporated herein by reference. Details of E-IISP can be found in U.S. patent application Ser. No. 08/697,220, entitled A METHOD OF ROUTING IN AN ASYNCHRONOUS TRANSFER MODE NETWORK, now U.S. Pat. No. 5,940,396, and incorporated herein by reference in its entirely. More information on ATM networks can be found in the book ATM: The New Paradigm for Internet, Intranet and Residential Broadband Services and Applications, Timothy Kwok, Prentice Hall, 1998.

Detailed Description Text (6):
It is important to note that the method of the present invention utilizes only the auto registration features of E-IISP. The routing features of PNNI are utilized rather than those of E-IISP.

Detailed Description Text (7):
Referring to FIG. 1, the ATM network, generally referenced 10, comprises three peer

groups labeled Peer A 20, Peer B 30 and Peer C 40. Each peer group comprises a plurality of nodes 50 each connected by links. Each peer group also comprises one or more border nodes that connect one peer group to another. Peer A comprises a single border node 52 that is connected to neighboring nodes via PNNI links 42 and 44. Peer B comprises three border nodes. Border node 54 is connected to border node 52 in Peer A via E-IISP link 70. Node 54 is also connected to its neighboring node via PNNI link 80. Node 58 is also a border node connected to border node 62 in Peer C via E-IISP link 72. Likewise, border node 60 is connected to border node 64 in Peer C via E-IISP link 74. Node 64 is connected to its neighboring nodes via PNNI links 46, 48.

Detailed Description Text (8):
Each peer group is assigned a peer group ID which consists of a 14 byte ID. The ID comprises 1 byte indicating the PNNI level in bits followed by 13 bytes indicating the address prefix up to the level number of bytes. In connection with addresses, the term significant length refers to number of valid bits of address prefix for a node configured originally. The significant length of an address prefix is less then or equal to 13 bytes (104 bits). The term PNNI level refers to the number of bits which defines the level of the node in the PNNI hierarchy. The PNNI level is also less than or equal to 13 bytes. Typically the PNNI level is less than or equal to the significant length.

Detailed Description Text (9):
Address prefixes consist of 13 bytes. Note that all nodes in the same peer group have the same PNNI level and thus the address prefix of each node up to the PNNI level number of bits is the same. The bits following the PNNI level number of bits until the significant length are unique for each node. The bits following the significant number of bits are padded with zeros and not used. During the network setup stage, a 20 byte destination address is assigned. The 20 byte addresses is made up of a 13 byte address prefix following by the 6 byte MAC address followed by a 1 byte selector field.

Detailed Description Text (10):
In the example presented herein to illustrate the method of the present invention, all the nodes in each peer have a PNNI level of 80, i.e., 10 bytes, in their PNNI configuration. Thus, the first 10 bytes of the prefix for each node in a peer group is common. The remaining 3 bytes are unique for each node within the peer group. All nodes in the network have the same 9 most significant bytes in their node address prefixes. In addition, each peer group has a peer group ID that is unique in the 10.sup.th byte of their prefix. All the nodes within the same peer have the same 10.sup.th byte in their node address prefix. Thus, the first 10 bytes of the address assigned to Peer A is 47.00.00.00.00.00.00.00.00.0A. The first 10 bytes assigned to Peer B is 47.00.00.00.00.00.00.00.00.0B. The first 10 bytes assigned to Peer C is 47.00.00.00.00.00.00.00.00.0C. The actual 14 byte peer group ID assigned to each peer group is shown in Table 1 below:

Detailed Description Text (11):
Referring to FIG. 1, each node in the network supports ports that can be either PNNI ports or E-IISP ports. Each node that has a port configured as a non-UNI port, runs the Hello protocol and associated FSM of the PNNI standard at all times regardless of whether it is configured as a PNNI port of an E-IISP port.

Detailed Description Text (12):
In operation, when a node receives the Hello message from a remote node, it examines the addresses to determine whether both node are in the same peer group or not. If the node determines that both nodes are in the same peer group then it configures that port as a PNNI type port. The regular Hello protocol, associated FSM and PTSE FSM are followed as if the link was a standard PNNI link. Note that in this example, two nodes will be in the same peer group if the two nodes are configured to have the same unique ID in the 10.sup.th byte of their address

prefix. In addition, since both nodes have the same PNNI level of 80, they are both at the same peer group level. Note that the peer group ID is extracted from the network prefix and level. Thus, the links between the nodes within each peer group are configured as PNNI links.

Detailed Description Text (15):
A logical flow diagram illustrating the combined routing scheme method of the present invention is shown in FIGS. 2A and 2B. The first step is that each node having a port configured as a non-UNI port runs the Hello protocol and associated FSM in accordance with the PNNI standard (step 170). When a Hello message is received (step 172) the peer group ID is extracted from the network prefix and level (step 174). It is then determined whether the node and remote node are from the same peer group (step 176).

Detailed Description Text (16):
If both nodes are from the same peer group, they both configure their ports as PNNI type ports (step 178). Processing continues with the Hello protocol and associated FSM in accordance with the PNNI standard (step 180). Also, PNNI standard PTSE FSM handling is also performed (step 182).

Detailed Description Text (17):
If it is determined that both nodes are, however, from different peer groups, the corresponding ports in both nodes are configured as E-IISP ports (step 184). Even though the port is configured as E-IISP, it retains PNNI functionality, e.g., the Hello protocol and FSM continues to run. One or more data elements are then exchanged between the ports (step 186). Data is exchanged via ILMI protocol which is commonly used to exchange information between two nodes. One of the data elements exchanged includes the addresses of other known border nodes (step 188). Each side sends the prefix plus the PNNI level (length) of its nodal address. Data can be exchanged via one of two ways (1) via peer group IDs in the Hello protocol messages or (2) via ILMI protocol method.

Detailed Description Text (19):
Once a node learns the addresses from its remote node, it first registers the address in its topology database (step 190). The node then floods the addresses throughout its peer (step 192). The node packages the address, indicating that the address is a local reachable address, into a PTSE and floods this PTSE to nodes within its peer group. In one embodiment, the node floods two PTSEs: one PTSE contains the actual address as a standard PTSE, the second non-mandatory PTSE contains data indicating that that particular address is an E-IISP address. The address can be tagged as an E-IISP address by setting one or more flags in the PTSE. Nodes that are programmed to implement the method of the present invention will receive and process the foreign address information accordingly. Nodes that do not implement the method of the present invention, however, will receive the PTSE which is considered unknown, store it, flood it and age it but will otherwise ignore it.

Detailed Description Text (20):
Using the method of the present invention, a network designer can build very large networks that do not have any hierarchy. Relatively small PNNI peer groups of, for example, 50 nodes or less, are connected together via E-IISP type links.

Detailed Description Text (21):
A diagram illustrating an example ATM network having three peers and the address exchanges between the border nodes is shown in FIG. 3. The three peer groups A, B, C are connected together via links 70, 72, 74. Using the method of FIGS. 2A and 2B, the links connecting nodes within the peer groups are configured as PNNI type links. The links connecting the border nodes 52 and 54; 58 and 62; 60 and 64 are configured as E-IISP type links.

Detailed Description Text (23):
In accordance with the present invention each node registers what it learns from the remote node, i.e., its remote peer, on the other side of the E-IISP link. Once registered, they are flooded throughout the entire PNNI portion of the network 10 thus permitting every destination to be reached.

Detailed Description Text (26):
Although node 62 also is registered with address A*, node C1 64 is chosen since node 64 is less costly than node 62. The DTL used for PNNI routing would include the following nodes (C2, C1). Node C1 realizes it is the last node in the DTL, thus local routing must be utilized. In other words, the call is routed to either a UNI port, E-IISP port or IISP port. All three cases are non PNNI domain ports. Thus, node C1 routes the call to node Peer B over link 74 without a DTL.

Detailed Description Text (28):
At border node A5 52 of Peer A, the call is handled as if a user directly connected to the node had requested the call. Thus, node A5 functions as if it was the originating (source) node. It thus performs a best match on the destination address (A*) which results in node A1 143 being chosen. A DTL is constructed comprising the nodes (A5, A4, A3, A2, A1). The call is then routed using standard PNNI routing to node A1 143 to which the destination user is attached.

Detailed Description Text (29):
It is an important aspect of the present invention that the ports on each node in the network that are configured as non-UNI ports, can change from PNNI type port to E-IISP port and vice versa. The main difference being that on a port configured as PNNI port, the standard PNNI protocol is active. While on the E-IISP ports, there is only an ILMI protocol that sends traps which include the foreign addresses learned by the node and stored in its PNNI topology database. The E-IISP port also functions to register any address that it receives from the remote node using the same mechanism. The node subsequently floods the foreign addresses to the other nodes in its peer group.

Detailed Description Text (30):
It is also important to note that the PNNI Hello protocol and associated FSM mechanism that is used to determine which type of port the port should be configured to. The Hello protocol mechanism is used since it is assumed that the nodes in the network support only the minimal PNNI subset implementation which does not support border nodes.

Detailed Description Text (31):
A diagram illustrating an example ATM network with a portion of the links disconnected is shown in FIG. 5. In this example, the links between Peers B and C are disconnected. The E-IISP link 70 connecting nodes 52, 54 remains intact. In particular, with reference to FIGS. 1 and 5, links 72, 74 are disconnected. Node 62 is reconnected to node 164 via link 162. Node 58 is reconnected to node 60 via link 160. Thus, links 160, 162 represent the new connections. Via the Hello protocol and FSM, the nodes determine that the nodes on either side of the link are from the same peer group. Thus, they configure their ports as PNNI type ports as indicated in FIG. 5.

Detailed Description Text (32):
Once the ports are re-configured as PNNI ports, the locally registered addresses are flushed from the topology database and corresponding PTSEs are flooded to the nodes within the peer group.

Detailed Description Paragraph Table (1):
Term Definition ANSI American National Standards Institute ATM Asynchronous Transfer Mode CCITT Comite Consulatif International Telegraphique et Telephonique DS Database Summary DTL Designated Transit List E-IISP Enhanced Interim Inter-

Switch Signaling Protocol FDDI Fiber Distributed Data Interface FSM Finite State Machine IISP Interim Inter-Switch Signaling Protocol ILMI Interim Local Management Interface ITU International Telecommunications Union NNI Net to Network Interface OSPF Open Shortest Path First PGL Peer Group Leader PNNI Private Network to Network Interface PTSE PNNI Topology State Element PTSP PNNI Topology State Packet RCC Routing Control Channel SVC Switched Virtual Circuit UNI User to Network Interface VCC Virtual Channel Connection

Current US Cross Reference Classification (2):
709/241

CLAIMS:

1. In an Asynchronous Transfer Mode (ATM) network having a plurality of nodes, said plurality of nodes configured to form one or more peer groups connected by one or more links, each node having a topology database and being capable of configuring each of its ports as either a Private Network Node Interface (PNNI) type port or an Enhanced Interim Inter-Switch Signaling Protocol (E-IISP) type port, a method of building ATM networks combining both PNNI and E-IISP schemes, said method comprising the steps of:

determining, on each node connected to a remote node via a link, whether the node and its remote node are from the same peer group;

configuring the port associated with the link as a PNNI type port if said node and its remote node are from the same peer group;

configuring the port associated with the link as an E-IISP type port if said node and its remote node are not from the same peer group;

transferring from the node to the remote node, all foreign addresses in the topology database of the node:

registering said foreign addresses received by the remote node in the topology database of the remote node; and

flooding said foreign addresses from the remote node to other nodes that are members of the peer group of the remote node.

2. The method according to claim 1, wherein said step of determining comprises the steps of:

executing a Hello protocol and associated Finite State Machine (FSM) of PNNI on each port configured as a non User to Network Interface (UNI) port; and

extracting a peer group ID from Hello messages received from a remote node located on the other side of the link each port is connected to.

3. The method according to claim 1, further comprising the step of executing a conventional Hello protocol and PNNI Topology State Elements (PTSE) Finite State Machines (FSMs) of PNNI.

4. The method according to claim 1, further comprising the step of executing a conventional Hello protocol and PNNI Topology State Elements (PTSE) Finite State Machines (FSMs) of PNNI on each port regardless of whether the port is configured as a PNNI type port or an E-IISP type port.

5. The method according to claim 1, further comprising the step of changing the configuration of a port from a PNNI type port to an E-IISP type port in response to one or more changes to the configuration of the network.

6. The method according to claim 1, further comprising the step of changing the configuration of a port from an E-IISP type port to a PNNI type port in response to one or more changes to the configuration of the network.

☐ 9. Document ID: US 6205146 B1

L8: Entry 9 of 15 File: USPT Mar 20, 2001

DOCUMENT-IDENTIFIER: US 6205146 B1
TITLE: Method of dynamically routing to a well known address in a network

Brief Summary Text (10):
The current standard solution for routing in a private ATM network is described in Private Network Node Interface (PNNI) Phase 0 and Phase 1 specifications published by ATM Forum. The previous Phase 0 draft specification is referred to as Interim Inter-Switch Signaling Protocol (IISP). The goal of the PNNI specifications is to provide customers of ATM network equipment some level of multi-vendor interoperability.

Brief Summary Text (36):
There is provided in accordance with the present invention, in an Asynchronous Transfer Mode (ATM) network having a plurality of nodes, a network server application implemented on one of the nodes, a method of routing to a well known address, the method comprising the steps of sending an indication message containing a cost value on a periodic basis out on all Network to Network Interface (NNI) ports in the node that implements the network server application, receiving a message containing the cost value on a node, registering the well known address and a received cost value associated therewith on the port receiving the indication message if the well known address has not been previously registered, updating an existing cost value with the received cost value, incrementing the received cost value by one to yield a new cost value, forwarding an indication message containing the new cost value out on ports having a larger cost value registered therewith and on ports without a registered cost value if the received cost value is smaller than or equal to the smallest cost value associated with other NNI ports and routing a call request to the network server application, made by a user connected to a node, via the port with the smallest cost value associated therewith.

Brief Summary Text (40):
There is also provided in accordance with the present invention, in an Asynchronous Transfer Mode (ATM) network having a plurality of nodes, a LAN Emulation Configuration Server (LECS) implemented one of the nodes, a method of routing to a well known address, the method comprising the steps of sending an indication message containing a hop count on a periodic basis out on all Network to Network Interface (NNI) ports in the node that implements the LECS, receiving a message containing the hop count on a node, registering the well known address and a received hop count associated therewith on the port receiving the indication message if the well known address has not been previously registered, updating an existing hop count with the received hop count, incrementing the received hop count by one to yield a new hop count, forwarding an indication message containing the new hop count out on ports having a larger hop count registered therewith and on

ports without a registered hop count if the received cost value is smaller than or equal to the smallest hop count associated with other NNI ports and routing a call request to the LECS, made by a user connected to a node, via the port with the smallest hop count associated therewith.

Detailed Description Text (10):
If the well known address is not registered on the NNI port that the message came in on, then the node registers it and assigns the hop count to it. If the well known address is already registered to the NNI port, the existing hop count associated with the registered address is updated with the hop count just received.

Detailed Description Paragraph Table (1):
Term Definition ANSI American National Standards Institute ATM Asynchronous Transfer Mode BUS Broadcast and Unknown Server CCITT Comite Consulatif International Telegraphique et Telephonique FDDI Fiber Distributed Data Interface FSM Finite State Machine IE Information Element IISP Interim Inter-Switch Signaling Protocol ILMI Interim Local Management Interface IP Internet Protocol ITU International Telecommunications Union LAN Local Area Network LANE LAN Emulation LEC LAN Emulation Client LECS LAN Emulation Configuration Server LES LAN Emulation Server LNNI LAN Emulation Network to Network Interface LUNI LAN Emulation User to Network Interface MAC Media Access Control NNI Net to Network Interface PNNI Private Network to Network Interface PTSE PNNI Topology State Element PTSP PNNI Topology State Packet PVC Permanent Virtual Circuit RCC Routing Control Channel SVC Switched Virtual Circuit SVCC Switched Virtual Channel Connection TLV Type Length Value UNI User to Network Interface VCC Virtual Channel Connection

Current US Cross Reference Classification (2):
709/238

Current US Cross Reference Classification (3):
709/239

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw De

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☐ 10. Document ID: US 6141325 A

L8: Entry 10 of 15 File: USPT Oct 31, 2000

DOCUMENT-IDENTIFIER: US 6141325 A
TITLE: Paradigm for enabling interoperability between different subnetworks

Brief Summary Text (8):
In order to enable topology updates, a rigid standard or paradigm for the topological data has to specify a fixed structure for the messages (syntax), as well as how they should be understood by network control (i.e., its semantics). The most prominent examples for this paradigm is the Private Network-to-Network (PNNI) standard for inter-network control of asynchronous transfer mode (ATM), and the Open Shortest Path First (OSPF) standard for Internet intra-domain routing. In other words, the network controller (NC) must know the standards and control format for each sub-network within the network. Often times the various standards of the sub-networks vary greatly thus requiring the NC at each node to replicate many standards and protocols.

Brief Summary Text (12):

The practice of topology aggregation is used in most of the standards and implementations of scalable networks. Topology aggregation refers to the reduction of complex topological data into smaller and simpler data which approximates the original data. A few examples of topology aggregation are the single level aggregation of Decnet (areas/hosts), the two level aggregation of IP (autonomous systems/networks/hosts), and the unbounded aggregation of the PNNI standard for ATM.

Detailed Description Text (4):
In addition to the high-level topology map, each node has to maintain information on the internals of each sub-net, since paths through different sub-nets may have very different characteristics. Instead of having to standardize the data maintained for each sub-net (as done in prior art) each node in the high-level topological view has a software agent 306 associated with it, residing at the local memory of network control (NC) at each node, as part of the topology database. This agent 306 is programmed according to the specific properties of the sub-net it represents and comprises its code and its storage 307. All information the network control at Node A1 knows regarding nodes in other sub-nets is acquired through standardized interfaces of their respective agents (i.e., a "black box" approach). Topology updates for other nodes travel in the network in some vendor-specific format, with very few standard fields, amongst which a logical address that enables network control at A1 to direct the update to the appropriate agent. Upon receipt of an update, the agent 306 processes it, and updates its internal data structure storage 307.

Detailed Description Text (6):
Prior to operation, the network must obtain the agent code for each node. When a new node joins the system, it lets its neighbors know its .type., which determines the agent which represents it. The type of a node may be its vendor (e.g., IBM), or a standard it complies to (e.g., PNNI low level node), a type of a supernode or domain may be a network operator (e.g., AT & T or America Online.SM.) which runs the sub-net, a standard (e.g., PNNI aggregated topology), or a sub-net type (e.g., LAN, RING, etc.). More often than not, the neighbors will already have agents of the same type. Hence they will already have the code of the new node's agent, and will not need it to be shipped to them. Otherwise, the new node will update the rest of the network with the code of its agent, encoded in some hardware independent standard format, such an JAVA.

Detailed Description Text (9):
Referring now to FIGS. 3 and 4, FIG. 3 shows a chart detailing the functions of an agent and FIG. 4 is a representative diagram. Specifically, each agent comprises a Find Address function, a Minimum Delay function, a Minimum Cost function, a Topology Update function, and a Setup Message function. Each are discussed in more detail below.

Detailed Description Text (10):
The Find Address function (FindAddress) avoids the need for a standard address format. The NC simply asks all of its node agents if a given address is inside them, until one of the agents takes responsibility for the address. Nodes complying with a hierarchical scheme may look at the relevant prefix of the input to decide (for example, "any address of the form 2.3.*.* is mine"). Other nodes may just have a list or a range of all addresses supported by them. Even here, the current scheme is more flexible than other inter-networking addressing schemes (e.g., the PNNI interface of the ATM forum or address resolution in current internet protocol (IP) and next generation IP (IPng)).

Detailed Description Text (13):
Referring again to FIG. 3, the agents' Minimum Delay (MinDelay) function is used to calculate an appropriate path to route the data packet to the sub-net containing the requested destination address. This path is calculated based on such factors as

bandwidth requirements, quality of service (QoS) requirements, and propagation delay. The various sub-nets or supernodes may choose different schemes for aggregating the topology. For example, some will have full knowledge of their internal sub-net's topology (no aggregation, but still independent format), some will have PNNI or IDRP aggregation, and some even simpler structures, not requiring updates at all. For example, a sub-net that accepts any 64 Kbps connection with fixed QoS, and only guarantees some fixed upper bound on the delay (any connection request with more demanding requirements is rejected by returning infinite delay) does not need topology updates at all.

Current US Cross Reference Classification (1):
709/242

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw. De

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☐ 11. Document ID: US 6085238 A

L8: Entry 11 of 15 File: USPT Jul 4, 2000

DOCUMENT-IDENTIFIER: US 6085238 A
**** See image for Certificate of Correction ****
TITLE: Virtual LAN system

Brief Summary Text (19):
On the other hand, in a connection-oriented ATM (asynchronous transfer mode) system, development of LAN emulation corresponding to the conventional LAN bridge, MPOA for providing a multiprotocol router on LAN emulation, an IP-over-ATM system for passing the IP on ATM, an IP-over-RSVP system for passing the RSVP on ATM, an IP switching system for switching only the IP on ATM, a 1-PNNI system for routing internet protocols on a private signaling protocol between ATM switches, and ATM-native transmission quality guarantee (QoS) technique is also pursued.

Brief Summary Text (35):
When the servers managed in a centralized manner in the network center are accessed or overlapped segments across segments are formed, communication traffic across layer 2 LAN switch segments increases. Then, a switch called a layer 3 LAN switch filtered based on the routing protocol address or the protocol type has been developed for floor line concentrators. With the layer 3 LAN switch, layer 3 virtual network segments based on logically defined protocol addresses independently of physical wiring like MAC addresses or ports are formed and may be called virtual subnet. Since the layer 3 LAN switch contains a router function, traffic across layer 2 subnets can also be directly switched not via the main router; subnets rather than flat subnets can be classified according to management policy or a fire wall for the routing protocol can be provided for enhancing security. If the layer 3 LAN switch is formed in an MPOA system on ATM LAN simulation, standardization is not yet complete, thus the layer 3 LAN switch may be installed under specifications proper to each vendor and limited transmission quality guarantee (QoS) is also provided. A backbone LAN system of routing between ATM switches in an I-PNNI system and using a layer 3 LAN switch as the edge LAN switch is also developed.

Detailed Description Text (12):
When ports differ although a client address match is found as a result of the virtual group identification for a terminal move, the virtual group identification section 1 outputs a port change message, the virtual group learning section 3 sends a topology change message to a virtual group distributed management section 9, which then learns in response to the topology change and dynamically updates the virtual group routing table 8.

Detailed Description Text (13):
By the way, if the connection ports of virtual groups are distributed over the LAN switches distributed over the network and the virtual group registration tables 2

and the virtual group routing tables 8 are distributed over the LAN switches, the virtual group identification section 1 of each LAN switch collates input port 41 . . . and the packet source address with the virtual group registration table 2 and detects topology change such as a terminal move, and the virtual group learning section 3 automatically updates the virtual group registration table 2 and the virtual group routing table 8.

Detailed Description Text (269):
When a port change message is output when ports differ although a client address match is found as a result of the virtual group identification for a terminal move, the virtual group learning section 316 sends a topology change message to the virtual group distributed management section 303, which then learns in response to a user environment message according to a user request and the topology change and dynamically updates the virtual group routing table 308.

Detailed Description Text (271):
The virtual group learning section 316 dynamically executes automatic configuration management for a terminal move. That is, when ports differ although a client address match is found as a result of the virtual group identification for a terminal move, the virtual group learning section 316 outputs a port change message for dynamically updating the virtual group registration table 301, thereby executing automatic configuration management automatically.

Detailed Description Text (273):
In the configuration in which the connection ports of virtual groups are distributed to the switches distributed over the network and the virtual group registration tables 301 and the virtual group routing tables 308 are distributed to the switches, the virtual group identification section 309 of each switch S has the virtual group learning section 316 for collating input port 341 . . . and the packet source address with the virtual group registration table 301, detecting topology change such as a terminal move, and automatically updating the virtual group registration table 301 and the virtual group routing table 311. The virtual group distributed management sections 303 of the switches S as virtual group agents VA dynamically manage the virtual group registration tables 301 and the virtual group routing tables 308 distributed to the switches S in coordination with each other based on topology change detection of a terminal move, a switch S move, etc., whereby virtual groups can be shared among the switches S in the network.

Detailed Description Text (391):
The optimum connection port address is entered in the virtual group registration/virtual group routing table shown in FIG. 61(a) as the routing connection port. That is, in the distributed switch configuration, another switch is cascaded to a port of one switch, thus for the port to which a switch is connected, the connection port becomes a port name corresponding to the optimum route reading to the home switch to which the terminal is connected. When a port change message is output when ports differ although a client address match is found as a result of the virtual group identification for a terminal move, the intranet virtual group learning/identification section 490 sends a topology change message to the virtual group distributed management section 488, which then learns in response to a user environment message according to a user request and the topology change and dynamically updates the virtual group routing table 485.

Detailed Description Text (393):
The virtual group learning section 487 dynamically executes automatic configuration management for a terminal move. When ports differ although a client address match is found as a result of the virtual group identification for a terminal move, the virtual group learning section 16 outputs a port change message and the intranet virtual group learning/identification section 490 dynamically updates the virtual group registration table, thereby executing automatic configuration management dynamically.

Detailed Description Text (395):
In the configuration in which the connection ports of virtual groups, namely, input ports 494a . . . of an input access control section 494 of the branch line concentration unit 414 are distributed to the distributed network service equipment 411 distributed over the network and the virtual group registration tables 486 and the virtual group routing tables 485 are distributed to the distributed network service equipment 411, the virtual group identification section 487 of each switch has the intranet virtual group learning/identification section 490 for collating input port 494a . . . and the packet source address with the virtual group registration table 486, detecting topology change such as a terminal move, and automatically updating the virtual group registration table 486 and the virtual group routing table 485. The virtual group distributed management sections 488 of the distributed network service equipment 411 as virtual group agents dynamically manage the virtual group registration tables 486 and the virtual group routing tables 485 distributed to the switches in coordination with each other based on topology change detection of a terminal move, a switch move, etc., whereby virtual groups are shared among the distributed network service equipment 411 in the network.

Current US Original Classification (1):
709/223

Current US Cross Reference Classification (2):
709/243

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw De

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☐ 12. Document ID: US 6021117 A

L8: Entry 12 of 15 File: USPT Feb 1, 2000

DOCUMENT-IDENTIFIER: US 6021117 A
TITLE: System for parameter analysis and traffic monitoring in asynchronous transfer mode (ATM) networks

Brief Summary Text (33):
Additionally in accordance with a preferred embodiment of the present invention the function which the ATM connection serves includes at least one of the following: PNNI, signaling, LAN-emulation.

Detailed Description Text (13):
application or function served, which may typically comprise one of the following: PNNI, signaling, LAN-emulation, or another appropriate function.

Detailed Description Text (21):
function served by the ATM connection such as, for example, a type of application service being provided by the ATM connection, such as, for example, LAN-emulation or PNNI.

Detailed Description Text (37):
function served by the ATM connection such as, for example, a type of application service being, provided by the ATM connection, such as, for example, LAN-emulation or PNNI.

Detailed Description Text (112):
The usage of the VC: PNNI, Signaling, LANE Control/Configuration, LANE 802.3 Data Direct, LANE 802.5 Data Direct, LANE 802.3 Multicast, LANE 802.5 Multicast, or "other".

Detailed Description Text (152):
4. The tables are updated whenever a new ATM address is identified, i.e., when a new VC is created and either of the two hosts communicating on this VC have not yet been registered in the host table.

Current US Cross Reference Classification (2):
709/224

CLAIMS:

29. A method according to claim 5 wherein said function which said ATM connection serves comprises PNNI.

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw. De

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13. Document ID: US 6002674 A

L8: Entry 13 of 15 File: USPT Dec 14, 1999

DOCUMENT-IDENTIFIER: US 6002674 A
TITLE: Network control system which uses two timers and updates routing information

Brief Summary Text (3):
The present invention relates to the update of routing control information. In a network where a plurality of switches each having an ATM (Asynchronous Transfer Mode) interface are interconnected, the switches make SVC (Switched Virtual Circuit) connection with each other by referring to the information produced by exchanging PNNI routing control packets (Hello packets and PTSP (PNNI Topology State Packets)).

Brief Summary Text (5):
PNNI (Private Network to Network Interface) Specification V1. 00 (hereafter called PNNI) from The ATM Forum Technical Committee describes the interface via which the switches in an ATM network make SVC connections. This PNNI contains information on the following:

Brief Summary Text (6):
(a) PNNI routing control packet exchange method and exchange information

Brief Summary Text (8):
The PNNI specifies that topology information be required for generating routing information. The topology information refers to network component information or state information on the network components such as lines and switches. This information is obtained by exchanging PNNI routing control packets the switches within the network.

Brief Summary Text (11):
(b) Routing information is generated when a PNNI routing control packet is received

Brief Summary Text (12):
(c) Topology information is generated from a received PNNI routing control packet and, at a specified interval, routing information is generated.

Brief Summary Text (14):
In case of (a), a delay in setting up a call from an originating terminal degrades the overall system performance. In case of (b), there is a possibility that a large number of PNNI routing control packets are received when a line or a switch in the network fails or when a condition (repetitive errors and error recovery processing) occurs. This condition causes routing information to be updated frequently, affecting the system performance. In case of (c), PNNI routing control packet information exchanged in the network is not reflected on the routing information immediately. Therefore, when an SVC connection request is received before routing information is updated by a PNNI routing control packet, the connection request may fail; conversely, when an error is already recovered but the routing information is not yet updated accordingly, the connection request may fail.

Brief Summary Text (17):
To achieve this objective, this system has two timers: the first timer sends the time-out signal at a specific interval and the second timer at an interval shorter than that of the first timer. The first timer sends the time-out signal at the longest interval for updating the routing information when the network is in the normal state. The second timer sends the time-out signal at the shortest interval for updating the routing information. The second timer generates the time-out signal at this interval to prevent a large number of PNNI routing control packets from being generated and the system performance from being degraded when a line or a switch in the network fails or when a line unbalance condition (repetitive errors and error recovery processing) occurs.

Detailed Description Text (3):
The first timer updates routing information immediately when it times out. That is, the first timer updates routing information at least once at a specified interval. On the other hand, the second timer updates routing information when it times out and if the significant-change detection flag is on at that time. This means that the interval of the second timer is the shortest interval at which routing information is updated. The significant-change detection flag is set to on only when a received PNNI routing control packet indicates that the registration of the address or the link of a terminal or the link of an ATM switch has been changed.

Detailed Description Text (4):
A system in this embodiment generates or updates routing information, not when a call request is received from a terminal, but when the first or the second timer times out. This eliminates a delay in setting up a call. When the system receives a large number of PNNI routing control packets, the system does not have to update a large volume of routing information because it updates the information at the interval of the second timer. This prevents the overall system performance from being degraded. In addition, a significant change, such as a change in terminal or ATM switch addresses or a change in link data, is reflected on routing information when the second timer times out. This allows a call from a terminal to be connected successfully.

Detailed Description Text (10):
The first timer 21 updates the routing information 24 at a specified interval. This interval is the longest interval at which the routing information 24 is updated. The routing information 24 is updated at least once at this interval even when the network is in the stable state (i.e. there is no change in terminal address and switch address, and there is no change in link configuration in which the switches are connected to each other).

Detailed Description Text (11):
On the other hand, the second timer 22 updates the routing information 24 at the shortest interval. A line failure, a switch failure, or a unbalance condition (repetitive errors and error recovery processing) on the network may generate a large number of PNNI routing control packets. This in turn causes the routing information to be updated often, affecting the overall system performance. The second timer 22, the shortest-interval time timer, prevents this condition.

Detailed Description Text (14):
The address/link information management module 31 manages the address information of the ATM switch 100 and link information denotes link configuration in which the switches are connected to each other, and the line speed and transmission delay thereon) and sends a PNNI routing control packet containing address information and link information to another ATM switch 300.

Detailed Description Text (15):
The topology information management module 32 manages topology information which is sent from another ATM switch 300 as PNNI routing control packets. Topology information is information on terminal addresses, switch addresses, line attributes, status, and so forth. Terminal addresses are those of the terminals (e.g., terminal 200 in FIG. 2) connected to an ATM switch (e.g., ATM switch 100 in FIG. 2). Switch addresses are those of the switches (e.g., ATM switch 100 or another ATM switch 300) configured in the network. Line attributes and status data denotes link configuration in which the switches are connected to each other and so forth. The line attributes and status data are stored in the address/link information management module 31 as link information.

Detailed Description Text (16):
The topology information management module 32 sends or receives PNNI routing control packets to or from another ATM switch 300 over the communication line to get topology information on each ATM switch and to keep topology information up to date. Topology information which is kept up to date in this manner keeps the ATM switch 100 informed of which ATM switches and terminals are available for use.

Detailed Description Text (17):
The significant change detection module 33 turns on the flag 33a upon detection of a pre-determined state in the network. In this embodiment, the significant change detection module 33 turns on the flag 33a (a) when the address information or link information of the ATM switch 100 is changed or (b) when a PNNI routing control packet indicating that the address information or link information of another ATM switch 300 is changed. Note that address information and link information may change according to how they are used for control.

Detailed Description Text (19):
The ATM switch 100 exchanges PNNI routing control packets with other ATM switches to keep address information and link information up to date for use as topology information. And, based on this topology information, the ATM determines a route to each terminal or switch in the network and keeps this routing information as the routing information 24. When the ATM receives an SVC connection request, it references the routing information 24 to find the best route to the destination terminal or switch.

Current US Cross Reference Classification (2):
709/242

Other Reference Publication (1):
af-pnni-0055.000 Letter Ballot, ATM Forum Technical Committee, pp. 36-37, 15-17, 357-364 and 40.

CLAIMS:

2. A network control system which controls switched virtual connection on a network, containing a plurality of interconnected switches each having an asynchronous transfer mode interface, by referencing routing information generated by exchanging PNNI routing control packets, the network control system comprising:

a significant change detection module setting a significant change detection flag to on upon detecting a pre-determined condition on the network;

a first timer generating a time-out signal at a specific interval;

a second timer generating a time-out signal at an interval shorter than that of the first timer; and

a routing information update control module having the routing information, unconditionally updating corresponding routing information upon receiving the time-out signal from the first timer, and updating the routing information upon receiving the time-out signal from the second timer only if the significant change detection flag is on.

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw. De

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☐ 14. Document ID: US 5903559 A

L8: Entry 14 of 15 File: USPT May 11, 1999

DOCUMENT-IDENTIFIER: US 5903559 A
**** See image for Certificate of Correction ****
TITLE: Method for internet protocol switching over fast ATM cell transport

Detailed Description Text (23):
Setting up and controlling switched paths is done using "inferred" IP signaling. This approach allows the reuse of a wide-array of existing IP protocol software with minimal modifications. Additional ATM hardware and software features are reused as much as possible with our IPSOFACTO method. This includes using ATM level hardware multicast for IP multicast as well reusing PNNI topology tables for routing and using UPC policies and CAC for RSVP.

Detailed Description Text (59):
Multicast OSPF (MOSPF) uses the OSPF unicast routing protocol (link-state) instead of RIP. This protocol is not widely used, but is attractive because it shares the same underlying unicast routing protocol as native ATM, namely PNNI.

Detailed Description Text (62):
With these protocols in mind, we can now discuss how IP multicast situations work with our inventive method. In the first situation, the IP protocols are run independent of the native ATM protocols. In the second situation the underlying unicast ATM routing protocol (PNNI) is reused for topology acquisition and the multicast IP is run on top of that.

Detailed Description Text (90):
Multicast IP/PNNI Extensions

Detailed Description Text (91):
In the above discussion it was assumed that IP multicast routing will be run on top of ATM hardware--independent of the ATM routing. However, it is possible to reuse the existing ATM routing protocol (PNNI) for the route selection without invoking PNNI signaling for route reservation. Since MOSPF uses the same underlying link-state protocol as PNNI it would be instructive to see how MOSPF works and then show our inventive modifications (if necessary) to PNNI which make it suitable for IP multicast.

Detailed Description Text (94):
In ATM, the same link-state topology exchange protocol exists and is hierarchical. So one option is to propagate the IP-multicast group membership for the local link as a part of the PNNI protocol exchange. This may be considered a layering violation but the topology/link-state exchange protocol is independent of the route computation IP-multicast routing should be supported "native" and in a peer-to-peer fashion with PNNI route selection except the fact that latter needs signaling and the former does nott. Consequently, our scheme for IP-multicast using PNNI topology acquisation scheme is summarized as follows.

Detailed Description Text (95):
When the first-hop router receives a (src,group) packet it computes the shortest path tree computation using the PNNI topology information. Since this information is hierarchical, the router will be able to compute the complete sub-tree undereath it and neighboring routers in the same peer group. PNNI uses source routing for its signaling so the entire path is forwarded in the signaling message in the existing ATM stack.

Detailed Description Text (97):
The IPSOFACTO implementation assumes a flat PNNI topology. The first-hop router receives the packet and computes a shortest path tree. For each outgoing branch it picks up an unused VP/VC on the port leading to the switch (next-hop router). It then creates a 1-2-m entry in its VP/VC table and starts soft-state on that VP/VC. The path is torn down if there is no activity for a period of time.

Detailed Description Text (98):
A problem with using the augmented PNNI approach (link state also contains group membership information) is that every change in the group members may trigger a flood of PNNI messages through the network. This is overcome in the hierarchical PNNI by updating group membership information only in a sub-domain and letting the rest of the network be blind to the actual members in each sub-domain.

Detailed Description Text (101):
If the fixed host is mobility-aware, i.e., it can receive location updates, (route-optimization extensions in IPv6) then the above doglegged ATM circuit will time out after the fixed host sends packets using the mobile's foreign address (and setting up a switched flow to the foreign address). Consequently, if the fixed host is mobility unaware, then for fixed to mobile flows when the mobile is moving, the home agent will receive a location updatefrom the mobile via a default IP PVC. Note that it is not necessary to transport this update over a switched path because the total number of packets for the update will not be a very large number.

Detailed Description Text (111):
In this situation, where there is mobility-aware-ATM, we let the original path be set up by mobile IP and then switched using the IPSOFACTO method previously described. When handoff occurs, however, the same mechanisms as were used with the mobile ATM handoff will be used to determine the crossover point and switch flows at that point. This requires that the mobile IP router as well as the mobile ATM module share the same topology tables that PNNI will produce.

Detailed Description Text (123):
For the generic IP-multicast situation, RESV merges will need to be done in the routed path, which will create 1-2-m ATM multicast VCs with the appropriate resource reservation parameters as well as set token buckets for each VC at the line interface card for monitoring and marking excess traffic. PATH messages will be forwarded based on the IP-mcast routing protocol (Dense mode or Sparse mode PIM or PNNI-augmented).

Current US Cross Reference Classification (5):
709/236

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw De

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☐ 15. Document ID: US 5828844 A

L8: Entry 15 of 15 File: USPT Oct 27, 1998

DOCUMENT-IDENTIFIER: US 5828844 A
TITLE: Internet NCP over ATM

Detailed Description Text (5):
Although both the IP and ATM routing protocols employed in the Classical IP model may determine reachability information for the same hosts, they run independently of one another. For example, IP routers run routing protocols such as RIP and OSPF exchange reachability information pertinent to IP destinations. Likewise, ATM switches run independent protocols such as PNNI to determine ATM network topology and address reachability. Typically, separate IP routers and ATM switches are provided. In fact, many networking scenarios even employ different IP and ATM network topologies.

Detailed Description Text (14):
Recently, a single device known as an IP switch has been developed. An IP switch integrates a conventional router and ATM switch to route IP over ATM networks much more efficiently than in the traditional model, which employs distinct devices. The IP over ATM model may be substantially simplified if the router and the ATM switch physically reside in the same device, as illustrated in FIG. 3. As previously mentioned, when the functionality of an ATM switch and an IP router reside on separate devices, the ATM switch does not have knowledge pertaining to routing and addressing at the IP layer. In contrast, when the functionality of an ATM switch and an IP router are merged onto the same device, it becomes possible to further integrate routing at the IP level into routing at the ATM level. For example, a perfect topology match is achieved when a layer two node (an ATM switch) is physically integrated into a layer three node (an IP router). Although this configuration does not eliminate the problem of matching an IP address with its corresponding ATM address, the elimination of the topological mismatch creates the opportunity to use a single routing protocol for routing at both the IP and ATM layers. An Illustrative protocol that may serve in this capacity includes I-PNNI (see R. Callon, Relationship Between MPOA and I-PNNI, April 1996, ATM Forum 96-0352), which has been submitted to the ATM Forum to integrate routing at the IPO layer into PNNI. I-PNNI facilitates the bootstrapping and ongoing operation of Internet routing protocols and associated packet forwarding protocols over an ATM network.

Detailed Description Text (23):
As seen in FIG. 3, the proxy server 53 functions in cooperation with an Internet

network control point (NCP) 54. The NCP 54, which is analagous to known network control points used in telephone networks that employ intelligent call processing, is the master database of the network which stores end-point information such as the correspondence between ATM, IP and MAC addresses, QoS requirements, special security filters, and billing properties. End-points can access the NCP 54 via the proxy server 53 to retrieve information and update the database as appropriate. That is, the proxy server 53 functions as a client interface to the NCP 54. The NCP 54 also may be updated in an automatic fashion by the individual IP switches in the network, such as when an endpoint registers or unregisters an IP to ATM address correspondence or a particular QoS.

Detailed Description Text (26):
The address database may also perform additional functions such as: receiving updated IP-ATM address registrations from clients or other address databases; receiving IP-ATM address deregistration requests from clients or other address databases; adding or deleting IP to ATM address correspondences from the database; receiving address queries from clients or other address databases; forwarding address query requests to clients or other address databases; forwarding address query responses; and receiving provisioned end-point information updates from the Internet NCP.

Detailed Description Text (27):
The address databases may be implemented in any convenient manner. Two possible implementations are a fully distributed implementation and a fully duplicated implementation. In the fully distributed approach, each IP switch only maintains an address database for those end-points that access the Internet at that particular IP switch. Accordingly, there is no need for synchronization among different address databases in different IP switches. For example, when a source end-point sends an address query to its IP switch regarding a destination end-point and the IP to ATM address correspondence is not found in the queried IP switch, the switch will forward the request only to the IP switch responsible for the destination end-point. In a fully distributed arrangement, the Internet NCP serves as the master database that stores all provisioned information for the network, including the IP to ATM address correspondences. When a change in the address database of an IP switch occurs (due to a host disconnecting from the IP switch, for example), the same change is forwarded to the Internet NCP to update the master database. Similarly, when the Internet NCP is modified by the service provider or the user, the appropriate individual address database(s) within the IP switch(es) will be updated accordingly.

Current US Original Classification (1):
709/228

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw De

Clear | Generate Collection | Print | Fwd Refs | Bkwd Refs | Generate OACS

Term	Documents
REPLAC$	0
REPLAC	19
REPLACA	1
REPLACABILITY	79
REPLACABLE	1257

REPLACABLEY	1
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REPLACABLY	188
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REPLACATED	2
(L7 AND ((REPLAC$ OR UPDAT$) WITH ADDRESS$)).USPT.	15

There are more results than shown above. Click here to view the entire set.

Display Format: KWIC Change Format

Previous Page Next Page Go to Doc#

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L14	L7 and (chang$ adj3 address$)	6	L14
L13	L7 and (chang$ with address$)	14	L13
L12	L7 and ((replac$ or chang$ or updat$) with address$)	20	L12
L11	L7 and SIG	5	L11
L10	L7 and SIG	5	L10
L9	L8 and (compar$ adj3 address$)	2	L9
L8	L7 and ((replac$ or updat$) with address$)	15	L8
L7	L4 or L5	74	L7
L6	L3 and PNNIATM	0	L6
L5	L3 and PNNI	74	L5
L4	L3 and (PTSE or PTSP)	11	L4
L3	709/$.ccls.	17245	L3
L2	L1 and ((replace$ or updat$) with (address$ adj2 compar$))	27	L2
L1	routing.ab.	7186	L1

END OF SEARCH HISTORY

Refine Search

Search Results -

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PREFIXES	3125
REPLAC$	0
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REPLACA	1
REPLACABILITY	79
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(L7 AND ((REPLAC$ OR CHANG$ OR UPDAT$) ADJ3 PREFIX)).USPT.	0

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Search: L16

Refine Search

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DATE: Wednesday, February 16, 2005 Printable Copy Create Case

Set Name **Query** **Hit Count** **Set Name**
side by side **result set**

DB=USPT; PLUR=YES; OP=ADJ

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Freeform Search

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- IBM Technical Disclosure Bulletins

Term: L1 and ((replace$ or updat$) with address$ with compar$).ab.

Display: 10 **Documents in Display Format:** KWIC **Starting with Number** 1

Generate: ○ Hit List ◉ Hit Count ○ Side by Side ○ Image

Search Clear Interrupt

Search History

DATE: Wednesday, February 16, 2005 Printable Copy Create Case

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L7	L1 and ((replace$ or updat$) with address$ with compar$).ab.	3	L7
L6	L1 and ((replace$ or updat$) with address$ with compar$)	125	L6
L5	L1 and ((replace$ or updat$) with (old adj1 address$) with (new adj1 address$))	4	L5
L4	L1 and ((replace$ or updat$) with old with new with address$)	51	L4
L3	L1 and ((replace$ or updat$) with compar$ with old with new with address$)	2	L3
L2	L1 and ((replace$ or updat$) with old with new with address$).ab.	3	L2
L1	network$.ab.	57180	L1

END OF SEARCH HISTORY

N G

L8: Entry 1 of 3 File: USPT Nov 30, 2004

DOCUMENT-IDENTIFIER: US 6826447 B2
TITLE: Process for the creation and enrichment of a data base of a post sorting system

Abstract Text (1):
This invention relates to a process for automatically creating and enriching a data base in a system for sorting mail items linked, through an INTRANET communications network, to computer stations of addressees of these mail items and comprising reading means for recognizing postal data printed on these mail items, processing means in order, in relation with a work data base comprising identification data relative to the addressees of the mail items, to identify the individual addressee of a determined mail item, and sorting means for allocating this mail item to the addressee thus identified, process in which there is firstly automatically sent to the electronic mail address of each addressee, a determined electronic message requesting him to be connected on a WEB page of the sorting system in order to enter personal identification data, and, once entered, these data are then automatically stored in a temporary data base for comparison with the data present in the work data base in order thus to ensure automatic update thereof.

US006826447B2

(12) **United States Patent**
Divine et al.

(10) **Patent No.: US 6,826,447 B2**
(45) **Date of Patent: Nov. 30, 2004**

(54) **PROCESS FOR THE CREATION AND ENRICHMENT OF A DATA BASE OF A POST SORTING SYSTEM**

(75) Inventors: **Marc Divine**, Sceaux (FR); **Laurent Henault**, Verrieres-le-Buisson (FR)

(73) Assignee: **Neopost Industrie**, Bagneux (FR)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 2 days.

(21) Appl. No.: **10/462,611**

(22) Filed: **Jun. 17, 2003**

(65) **Prior Publication Data**

US 2004/0034446 A1 Feb. 19, 2004

(30) **Foreign Application Priority Data**

Jun. 17, 2002 (FR) 02 07419

(51) **Int. Cl.**^{7} **G06F 7/00**; G06F 17/00; B07C 5/00; G06K 9/00

(52) **U.S. Cl.** **700/224**; 700/225; 700/223; 209/584; 209/629; 209/630; 707/100; 707/102

(58) **Field of Search** 700/223, 224, 700/225, 226; 209/584, 629, 630; 707/100, 101, 102

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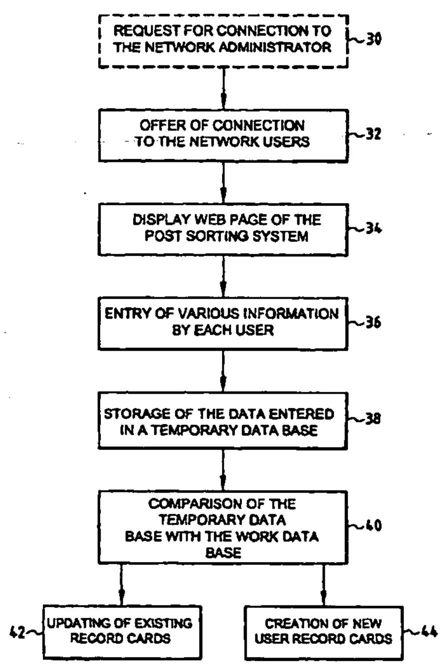
Primary Examiner—Gene O. Crawford
(74) *Attorney, Agent, or Firm*—Sughrue Mion, PLLC

(57) **ABSTRACT**

This invention relates to a process for automatically creating and enriching a data base in a system for sorting mail items linked, through an INTRANET communications network, to computer stations of addressees of these mail items and comprising reading means for recognizing postal data printed on these mail items, processing means in order, in relation with a work data base comprising identification data relative to the addressees of the mail items, to identify the individual addressee of a determined mail item, and sorting means for allocating this mail item to the addressee thus identified, process in which there is firstly automatically sent to the electronic mail address of each addressee, a determined electronic message requesting him to be connected on a WEB page of the sorting system in order to enter personal identification data, and, once entered, these data are then automatically stored in a temporary data base for comparison with the data present in the work data base in order thus to ensure automatic update thereof.

10 Claims, 2 Drawing Sheets



L8: Entry 2 of 3 File: USPT Jun 10, 2003

DOCUMENT-IDENTIFIER: US 6578085 B1
TITLE: System and method for route optimization in a wireless internet protocol network

Abstract Text (1):
A system and method for route optimization in a wireless Internet Protocol (IP) network. The system and method send, to a home agent, a data packet; transmit, to a mobile node, the data packet using a first address; maintain a list of correspondent nodes associated with the mobile node; send, to the correspondent node, a binding update message; and transmit, directly to the mobile node, subsequent data packets using the first address. The system and method additionally: transmit, to a home agent, a registration request comprising a new address; transmit, to a mobile node, a registration reply in response to the registration request; compare the new address to an old address; if the new address and the old address are not equal, transmit, to the correspondent node, a binding update message; transmit, to the home agent, a binding acknowledgment in response to the binding update message; and transmit, to the mobile node, all subsequent messages via the new address.

US006578085B1

(12) **United States Patent**
Khalil et al.

(10) **Patent No.: US 6,578,085 B1**
(45) **Date of Patent: Jun. 10, 2003**

(54) **SYSTEM AND METHOD FOR ROUTE OPTIMIZATION IN A WIRELESS INTERNET PROTOCOL NETWORK**

(75) Inventors: **Mohamed M. Khalil**, Dallas, TX (US); **Emad Q. Qaddoura**, Plano, TX (US); **Haseeb Akhtar**, Garland, TX (US); **Liem Le**, Richardson, TX (US)

(73) Assignee: **Nortel Networks Limited**, St. Laurent (CA)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/369,944**

(22) Filed: **Aug. 6, 1999**

Related U.S. Application Data

(60) Provisional application No. 60/117,371, filed on Jan. 27, 1999.

(51) **Int. Cl.**[7] **G06F 13/14**
(52) **U.S. Cl.** **709/241**; 709/245
(58) **Field of Search** 370/313, 356, 370/409, 466, 328, 338; 455/433, 435; 709/228, 238, 241, 245

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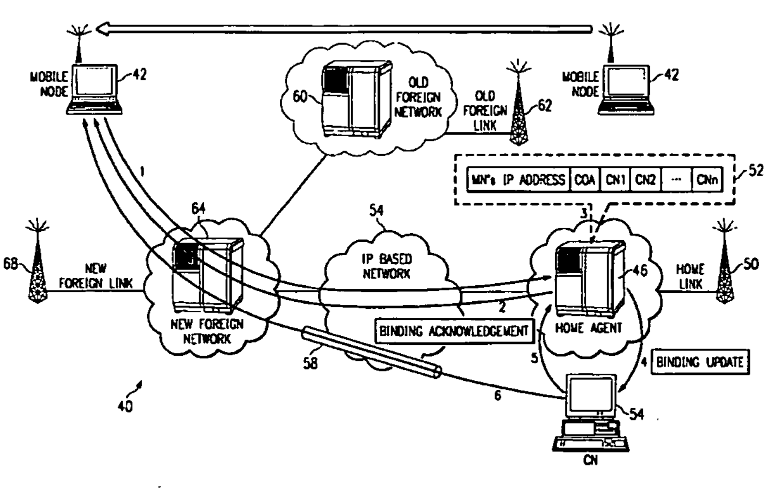
(List continued on next page.)

Primary Examiner—Christine K. Oda
Assistant Examiner—Walter Benson
(74) *Attorney, Agent, or Firm*—Haynes and Boone, LLP

(57) **ABSTRACT**

A system and method for route optimization in a wireless Internet Protocol (IP) network. The system and method send, to a home agent, a data packet; transmit, to a mobile node, the data packet using a first address; maintain a list of correspondent nodes associated with the mobile node; send, to the correspondent node, a binding update message; and transmit, directly to the mobile node, subsequent data packets using the first address. ~~The system and method additionally transmit, to a home~~ agent, a registration request comprising a new address; transmit, to a mobile node, a registration reply in response to the registration request; compare the new address to an old address; if the new address and the old address are not equal, transmit, to the correspondent node, a binding update message; transmit, to the home agent, a binding acknowledgment in response to the binding update message; and transmit, to the mobile node, all subsequent messages via the new address.

38 Claims, 9 Drawing Sheets



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* cited by examiner

Previous Doc Next Doc Go to Doc#
First Hit Fwd Refs

Generate Collection

L8: Entry 3 of 3 File: USPT Oct 24, 2000

DOCUMENT-IDENTIFIER: US 6138161 A
TITLE: Method and system for maintaining reserve command relationships in a fibre channel network

Abstract Text (1):
A method and system for maintaining a unique reserve command relationship between an initiator and a target device in a Fibre Channel network across network address changes after a break in communication. The present invention maintains triplet tables containing data triplets, comprised of the network address, the port name, and the node name, for each initiator and each target device. Following a break in network communication that results in the network address of an initiator and/or a target device changing, the method of the present invention updates the recorded network addresses for the initiators and the target devices, maintains any previously-existing unique reserve command relationships and continues with I/O transmission. Although the network address of an initiator may change, the node name and port name of the initiator will remain the same. By comparing the initiator port name and node name contained in a reserve table maintained in the target device to the node name and port name corresponding to the now updated network address for an initiator with which it was in a unique reserve command relationship prior to the break in communication, a target device can then simply update the network address for the initiator and no disruption in I/O traffic will result.

Previous Doc Next Doc Go to Doc#

US006138161A

United States Patent [19]

[11] Patent Number: 6,138,161
[45] Date of Patent: Oct. 24, 2000

Reynolds et al.

[54] **METHOD AND SYSTEM FOR MAINTAINING RESERVE COMMAND RELATIONSHIPS IN A FIBRE CHANNEL NETWORK**

[75] Inventors: **Robert A. Reynolds**, Pflugerville; **Keith M. Arroyo**; **Stephen K. Wilson**, both of Austin, all of Tex.

[73] Assignee: **Crossroads Systems, Inc.**, Austin, Tex.

[21] Appl. No.: **09/251,759**

[22] Filed: **Feb. 18, 1999**

[51] **Int. Cl.**[7] **G06F 15/16**; G06F 15/177; G06F 15/173

[52] **U.S. Cl.** **709/227**; 709/221; 709/245; 709/242; 370/392

[58] **Field of Search** 709/242, 227, 709/221, 250, 237, 245; 370/392

[56] **References Cited**

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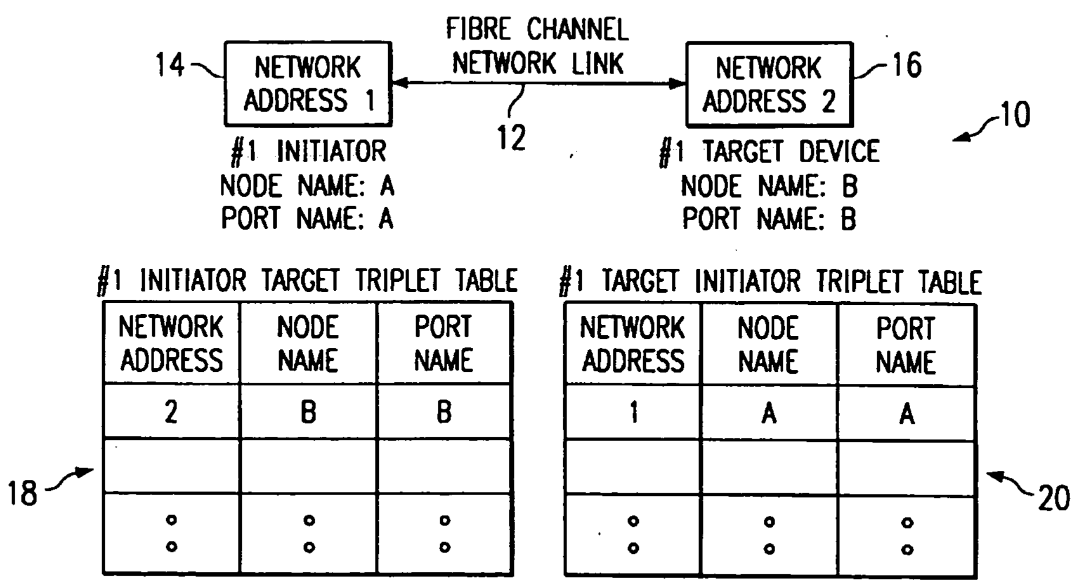
Primary Examiner—Dung C. Dinh
Assistant Examiner—Bradley Edelman
Attorney, Agent, or Firm—Gray Cary Ware & Freidenrich, LLP

[57] **ABSTRACT**

A method and system for maintaining a unique reserve command relationship between an initiator and a target device in a Fibre Channel network across network address changes after a break in communication. The present invention maintains triplet tables containing data triplets, comprised of the network address, the port name, and the node name, for each initiator and each target device. Following a break in network communication that results in the network address of an initiator and/or a target device changing, the method of the present invention updates the recorded network addresses for the initiators and the target devices, maintains any previously-existing unique reserve command relationships and continues with I/O transmission. Although the network address of an initiator may change, the node name and port name of the initiator will remain the same. By comparing the initiator port name and node name contained in a reserve table maintained in the target device to the node name and port name corresponding to the now updated network address for an initiator with which it was in a unique reserve command relationship prior to the break in communication, a target device can then simply update the network address for the initiator and no disruption in I/O traffic will result.

32 Claims, 4 Drawing Sheets



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Derwent World Patents Index
IBM Technical Disclosure Bulletins

Term: L1 and ((replace$ or updat$) with (address$ adj2 compar$))

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Generate: ○ Hit List ◉ Hit Count ○ Side by Side ○ Image

Search Clear Interrupt

Search History

DATE: Wednesday, February 16, 2005 Printable Copy Create Case

L10/2, 3,

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L9	L1 and ((replace$ or updat$) with address$ with compar$).ab.	3	L9
L8	L1 and ((replace$ or updat$) with address$ with compar$).ab.	3	L8
L7	L1 and ((replace$ or updat$) with address$ with compar$).ab.	3	L7
L6	L1 and ((replace$ or updat$) with address$ with compar$)	125	L6
L5	L1 and ((replace$ or updat$) with (old adj1 address$) with (new adj1 address$))	4	L5
L4	L1 and ((replace$ or updat$) with old with new with address$)	51	L4
L3	L1 and ((replace$ or updat$) with compar$ with old with new with address$)	2	L3
L2	L1 and ((replace$ or updat$) with old with new with address$).ab.	3	L2
L1	network$.ab.	57180	L1

END OF SEARCH HISTORY

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IBM Technical Disclosure Bulletins

Term: L1 and ((replace$ or updat$) with (address$ adj2 compar$))

Display: 10 **Documents in Display Format:** KWIC **Starting with Number** 1

Generate: ○ Hit List ◉ Hit Count ○ Side by Side ○ Image

Search Clear Interrupt

Search History

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END OF SEARCH HISTORY

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Search Results -

Term	Documents
SIG	4790
SIGS	156
(7 AND SIG).USPT.	5
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Database:

US Pre-Grant Publication Full-Text Database
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Search: L11

Refine Search

Recall Text Clear Interrupt

Search History

DATE: Wednesday, February 16, 2005 Printable Copy Create Case

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L10	L7 and SIG	5	L10
L9	L8 and (compar$ adj3 address$)	2	L9
L8	L7 and ((replac$ or updat$) with address$)	15	L8
L7	L4 or L5	74	L7
L6	L3 and PNNIATM	0	L6
L5	L3 and PNNI	74	L5
L4	L3 and (PTSE or PTSP)	11	L4
L3	709/$.ccls.	17245	L3
L2	L1 and ((replace$ or updat$) with (address$ adj2 compar$))	27	L2
L1	routing.ab.	7186	L1

END OF SEARCH HISTORY

Hit List

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Search Results - Record(s) 1 through 6 of 6 returned.

☐ 1. Document ID: US 6788649 B1

L14: Entry 1 of 6 File: USPT Sep 7, 2004

DOCUMENT-IDENTIFIER: US 6788649 B1
TITLE: Method and apparatus for supporting ATM services in an intelligent network

Brief Summary Text (8):
The signaling protocol is defined in ATM standards according to network interfaces. The ATM Forum has defined, among other interfaces, a public User-Network Interface ("UNI"), defined as the interface between an ATM user and a public ATM network; a private User-Network Interface, defined as the interface between an ATM user and a private ATM network; and, a Private Network-Network Interface ("PNNI") defined as the network-network interface between two private networks or switching systems. Various features of ATM are enabled by signaling messages defined by these interfaces.

Detailed Description Text (20):
Additionally NGIN supports ATM one number services capability including: 1) Find me/Follow me wherein given an address that is assigned to a particular subscriber, that subscriber may change the destination associated with that address. The feature that would be provided with this capability enables a subscriber to receive calls as they move locations; and, 2) Alternate routing wherein if a destination is unavailable, it is possible to specify an alternate destination.

Detailed Description Text (56):
In addition to the foregoing, NGIN is capable of supporting the following functional requirements relating to Vnet service including, but not limited to: 1) the ability for national and international dialed VNET numbers to be screened; 2) the ability to translate VNET dialed number digits to a format (such as outpulse digits) that an NGS switch will understand, in order to support national or international DAL and Direct Distance Dialing (DDD) terminations; 3) the ability to allow international VNET calls to have a predetermined format including, for example, three (3) digits for identifying the country and the seven (7) digits indicating the private network number; 4) the capability to change the termination address obtained from the originating party and reroute the call to an alternate termination (Call Rerouting/Alternate Routing). The alternate termination may be a NANP DDD number, a Vnet termination, a mobile phone number, an international termination number IDDD, an ACD or a voice/fax mail system, etc. and any change made may be transparent to the calling party if necessary; 5) providing NXX Exchange Routing involving the use of the exchange code, and the Area ID (retrieved by using the customers NXX Exchange routing plan id), instead of the normal geographic lookup information, when performing termination translation; 6) providing the ability for VNET calls to be screened at the corporate, network, or access (originating switch, carrier) levels (Range Privilege Screening); 7) the ability to provide Remote Access to VNET, i.e., to designate 800, 900, and global freephone numbers for remote access to VNET. When such a number is dialed, a VNET

dial tone is provided, as well as the nature of permissible VNET addresses, and how many supplementary digits to collect; 8) ability to provide a Route Data Calls capability, i.e., the ability for customers to order all digital routing for their VNET service. A digital route indicator (uses switch 56 path) is sent to the switch along with the route translation; 9) the support of private dialing plans of any business or residential customer. Currently, VNET customers may create their own network dialing plans, e.g., 4-12 digit national numbers dialing plans, and 7-15 digit international dialing plans may be defined; 10) the ability to perform VNET Card Validation, e.g., via an ADF message; 11) the ability to perform a Vnet work at home voice services, i.e., employees who work at home may be assigned a business number to their home phone. When they make business phone calls, they may use the Vnet service by dialing a *feature code prior to the Vnet number. The NGIN Vnet SLP accesses the Vnet dialing plan of the customer; translates the number to the Vnet termination; and charges the call to the Vnet business customer automatically. When an incoming call is received, a distinctive ringing may be applied to alert the user of a business call; and, 12) the capability to deactivate VNET cards and enable a user to deactivate VNET cards.

Current US Cross Reference Classification (6):
709/202

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw. De

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☐ 2. Document ID: US 6724724 B1

L14: Entry 2 of 6 File: USPT Apr 20, 2004

DOCUMENT-IDENTIFIER: US 6724724 B1
**** See image for Certificate of Correction ****
TITLE: System and method for resolving an electronic address

Brief Summary Text (9):
Each router 18, 22 typically maintains a table of address translations, such as the translation of device 22's X.25 address to device 22's TCP/IP address. These addresses are typically hard coded into the routers 18-20. Accordingly, if an address for a device changes, then each router 18-20 that includes that device's address will typically need to be accessed and the address will have to be changed. Since it is fairly common for a network to have its address scheme changed, it may be substantially time consuming to ensure that each router that contained each of the changed addresses is accessed and updated. Additionally, the process of individually changing an address in all the routers that maintain that address may be error prone.

Brief Summary Text (10):
It would be desirable to have an address resolution system and method that allows dynamic changes to addresses and avoid the need to access each router containing the address to change that address. The present invention addresses such a need.

Detailed Description Text (20):
If no translation is required, then device B is directly contacted (step 206). If, however, the route to device B does require translation, then a name resolution service, such as a domain name server (DNS) is contacted (step 208). The DNS which is contacted by the router may be a DNS local to the router, or a specific DNS identified in the router's routing table that contains the information to facilitate the address translation. Accordingly, only a relatively small number of

DNSs would require updates of changes of addresses in order to dynamically affect all routers requesting that address.

Current US Cross Reference Classification (3):
709/230

Other Reference Publication (3):
Dillon, Kevin, "PNNI: Effortless Expansion for ATM Networks", Dialog (R) File 647, ATM Forum Bay Networks, Nov. 7, 1998.

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw De

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☐ 3. Document ID: US 6606303 B1

L14: Entry 3 of 6 File: USPT Aug 12, 2003

DOCUMENT-IDENTIFIER: US 6606303 B1
TITLE: Method and device in a packet switched network

Brief Summary Text (6):
In a private Asynchronous Transfer Mode (ATM) network the PNNI function, as specified by the ATM Forum will probably become the chosen function for resource management with respect to routing and signalling, and other functions. A part of the PNNI is a so called dynamic routing protocol meaning that a node in the network will announce and update information regarding its own identity, the resources on its outgoing links and in the node, and address reachability, to all neighboring nodes. This way, in the end all nodes in the network will have a complete hierarchical view of the topology of the network, including its available resources.

Brief Summary Text (7):
The PNNI protocol is defined for use between private ATM switches and between private ATM networks. The abbreviation PNNI stands for either Private Network Node Interface or Private Network-to-Network Interface, reflecting these two areas of use. PNNI routing is used in a private network of ATM switching systems. PNNI includes a routing protocol for distribution of topology information between switches and groups of switches. The functions of the PNNI routing protocol include, among other things: discovery of neighbours and link and node status, synchronization of topology databases, construction of the routing hierarchy, transmission of PNNI topology state elements from each node to all other nodes.

Brief Summary Text (11):
To avoid the problems of hop-by-hop routing PNNI uses source routing for all connection setup requests. The first node in a peer group selects the entire path across that peer group and across all other peer groups for the purpose of reaching the destination. The path is encoded as a set of Designated Transit Lists (DTLs) explicitly included in the connection setup request. The DTLs specify every node used in transit across the peer group and may also specify the logical links to be used between the nodes. If a node along the path is unable to follow the DTL for a specific connection setup request the node must perform a so called crankback, that is, return the connection setup request to the node in which the DTL was created.

Brief Summary Text (18):
Routing for connections with multiple performance constraints complicates the problem in two ways. First, each link must be described in terms of multiple

parameters. Second, the ability of a link to participate in a path depends on the requirements of the connection being routed. Having fill topology information and status about actual network resources and capacity is necessary to be able to compare different link costs with each other in order to build least-cost routes to every other destination in the network. The PNNI distributes complete routing information to all nodes, making it desirable to use Dijkstra's algorithm, which, however can only optimize on one parameter. For example, the path for which the delay is minimized may very well have an unacceptably low bandwidth or high delay variation, or vice versa.

Brief Summary Text (30):
The parameters used comprise the maximum cell transfer delay (CTD), the peak-to-peak Cell Delay Variation (CDV), the Available Cell Rate (AvCR), the Maximum Cell Rate (MCR) and the Cell Loss Ratio (CLR). An Administrative Weight (AW) may also be included. These parameters are specified in the PNNI routing specification, agreed by the ATM Forum, and will be explained in somewhat more detail below.

Brief Summary Text (36):
The routing with respect to multiple constraints in a PNNI network environment specifically addressing the traffic contracts of the rt-VBR service categories is enabled.

Drawing Description Text (2):
FIG. 1 shows schematically a packet switch network with two hierarchical levels according to the PNNI protocol.

Detailed Description Text (2):
FIG. 1 is a schematic representation of a packet switch network comprising a number of logical nodes and with two hierarchical levels. The lowest level of the PNNI hierarchy comprises the logical nodes that are organized into peer groups. The nodes in a peer group exchange information with the other nodes in the group, so that all nodes in the group have an identical view of the group and of other peer groups. Each logical node sees all nodes in its own peer group, but sees every other peer group only as a single node.

Detailed Description Text (11):
In PNNI, links are advertised unidirectionally, in the outgoing direction, but connections are always bidirectional, both directions using the same route. Therefore, the associated total link cost of a bidirectional link takes the network resources allocated both directions into consideration when computing the link cost.

Detailed Description Text (39):
A routing table is updated when the available resources of a node or link is changed or when the address reachability in the network is changed.

Current US Cross Reference Classification (2):
709/241

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw De

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☐ 4. Document ID: US 6085238 A

L14: Entry 4 of 6 File: USPT Jul 4, 2000

DOCUMENT-IDENTIFIER: US 6085238 A

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**** See image for Certificate of Correction ****
TITLE: Virtual LAN system

Brief Summary Text (19):
On the other hand, in a connection-oriented ATM (asynchronous transfer mode) system, development of LAN emulation corresponding to the conventional LAN bridge, MPOA for providing a multiprotocol router on LAN emulation, an IP-over-ATM system for passing the IP on ATM, an IP-over-RSVP system for passing the RSVP on ATM, an IP switching system for switching only the IP on ATM, a 1-PNNI system for routing internet protocols on a private signaling protocol between ATM switches, and ATM-native transmission quality guarantee (QoS) technique is also pursued.

Brief Summary Text (35):
When the servers managed in a centralized manner in the network center are accessed or overlapped segments across segments are formed, communication traffic across layer 2 LAN switch segments increases. Then, a switch called a layer 3 LAN switch filtered based on the routing protocol address or the protocol type has been developed for floor line concentrators. With the layer 3 LAN switch, layer 3 virtual network segments based on logically defined protocol addresses independently of physical wiring like MAC addresses or ports are formed and may be called virtual subnet. Since the layer 3 LAN switch contains a router function, traffic across layer 2 subnets can also be directly switched not via the main router; subnets rather than flat subnets can be classified according to management policy or a fire wall for the routing protocol can be provided for enhancing security. If the layer 3 LAN switch is formed in an MPOA system on ATM LAN simulation, standardization is not yet complete, thus the layer 3 LAN switch may be installed under specifications proper to each vendor and limited transmission quality guarantee (QoS) is also provided. A backbone LAN system of routing between ATM switches in an I-PNNI system and using a layer 3 LAN switch as the edge LAN switch is also developed.

Detailed Description Text (128):
Further, the following constitution can be adopted to the port segment switch in the present invention. That is, when the terminal is moved between the ports in one switch, or when the terminal is moved between the switches, the switch which is over layer 2 of the virtula LAN system on the back born side and connected to the expansion port detects the correspondence change of MAC address or network address with the microsegment, so that the virtual group agent executes the dynamic automatic configulation management.

Detailed Description Text (210):
On the other hand, VLAN-IDs may be set independently of internet protocol subnets, a plurality of virtual subnets or virtual segments may be set in a router internet subnet, or a VLAN virtual subnet or virtual segment may be set across router internet subnets. In this case, the LAN switches (local router switch 202 and local switches 203a . . . which need to execute routing based on VLAN-ID, comprise an intranet routing table apart from an internet routing table. In the above-mentioned IPv6, a local address and a provider address are separated at the header. A fire wall section 213 of the main router 201 has a function of changing an internet IP address and an intranet IP address to different addresses.

Current US Original Classification (1):
709/223

Current US Cross Reference Classification (2):
709/243

☐ 5. Document ID: US 6002674 A

L14: Entry 5 of 6 File: USPT Dec 14, 1999

DOCUMENT-IDENTIFIER: US 6002674 A
TITLE: Network control system which uses two timers and updates routing information

Brief Summary Text (3):
The present invention relates to the update of routing control information. In a network where a plurality of switches each having an ATM (Asynchronous Transfer Mode) interface are interconnected, the switches make SVC (Switched Virtual Circuit) connection with each other by referring to the information produced by exchanging PNNI routing control packets (Hello packets and PTSP (PNNI Topology State Packets)).

Brief Summary Text (5):
PNNI (Private Network to Network Interface) Specification V1. 00 (hereafter called PNNI) from The ATM Forum Technical Committee describes the interface via which the switches in an ATM network make SVC connections. This PNNI contains information on the following:

Brief Summary Text (6):
(a) PNNI routing control packet exchange method and exchange information.

Brief Summary Text (8):
The PNNI specifies that topology information be required for generating routing information. The topology information refers to network component information or state information on the network components such as lines and switches. This information is obtained by exchanging PNNI routing control packets the switches within the network.

Brief Summary Text (11):
(b) Routing information is generated when a PNNI routing control packet is received

Brief Summary Text (12):
(c) Topology information is generated from a received PNNI routing control packet and, at a specified interval, routing information is generated.

Brief Summary Text (14):
In case of (a), a delay in setting up a call from an originating terminal degrades the overall system performance. In case of (b), there is a possibility that a large number of PNNI routing control packets are received when a line or a switch in the network fails or when a condition (repetitive errors and error recovery processing) occurs. This condition causes routing information to be updated frequently, affecting the system performance. In case of (c), PNNI routing control packet information exchanged in the network is not reflected on the routing information immediately. Therefore, when an SVC connection request is received before routing information is updated by a PNNI routing control packet, the connection request may fail; conversely, when an error is already recovered but the routing information is not yet updated accordingly, the connection request may fail.

Brief Summary Text (17):
To achieve this objective, this system has two timers: the first timer sends the

time-out signal at a specific interval and the second timer at an interval shorter than that of the first timer. The first timer sends the time-out signal at the longest interval for updating the routing information when the network is in the normal state. The second timer sends the time-out signal at the shortest interval for updating the routing information. The second timer generates the time-out signal at this interval to prevent a large number of PNNI routing control packets from being generated and the system performance from being degraded when a line or a switch in the network fails or when a line unbalance condition (repetitive errors and error recovery processing) occurs.

Detailed Description Text (3):
The first timer updates routing information immediately when it times out. That is, the first timer updates routing information at least once at a specified interval. On the other hand, the second timer updates routing information when it times out and if the significant-change detection flag is on at that time. This means that the interval of the second timer is the shortest interval at which routing information is updated. The significant-change detection flag is set to on only when a received PNNI routing control packet indicates that the registration of the address or the link of a terminal or the link of an ATM switch has been changed.

Detailed Description Text (4):
A system in this embodiment generates or updates routing information, not when a call request is received from a terminal, but when the first or the second timer times out. This eliminates a delay in setting up a call. When the system receives a large number of PNNI routing control packets, the system does not have to update a large volume of routing information because it updates the information at the interval of the second timer. This prevents the overall system performance from being degraded. In addition, a significant change, such as a change in terminal or ATM switch addresses or a change in link data, is reflected on routing information when the second timer times out. This allows a call from a terminal to be connected successfully.

Detailed Description Text (10):
The first timer 21 updates the routing information 24 at a specified interval. This interval is the longest interval at which the routing information 24 is updated. The routing information 24 is updated at least once at this interval even when the network is in the stable state (i.e. there is no change in terminal address and switch address, and there is no change in link configuration in which the switches are connected to each other).

Detailed Description Text (11):
On the other hand, the second timer 22 updates the routing information 24 at the shortest interval. A line failure, a switch failure, or a unbalance condition (repetitive errors and error recovery processing) on the network may generate a large number of PNNI routing control packets. This in turn causes the routing information to be updated often, affecting the overall system performance. The second timer 22, the shortest-interval time timer, prevents this condition.

Detailed Description Text (14):
The address/link information management module 31 manages the address information of the ATM switch 100 and link information denotes link configuration in which the switches are connected to each other, and the line speed and transmission delay thereon) and sends a PNNI routing control packet containing address information and link information to another ATM switch 300.

Detailed Description Text (15):
The topology information management module 32 manages topology information which is sent from another ATM switch 300 as PNNI routing control packets. Topology information is information on terminal addresses, switch addresses, line attributes, status, and so forth. Terminal addresses are those of the terminals

(e.g., terminal 200 in FIG. 2) connected to an ATM switch (e.g., ATM switch 100 in FIG. 2). Switch addresses are those of the switches (e.g., ATM switch 100 or another ATM switch 300) configured in the network. Line attributes and status data denotes link configuration in which the switches are connected to each other and so forth. The line attributes and status data are stored in the address/link information management module 31 as link information.

Detailed Description Text (16):
The topology information management module 32 sends or receives PNNI routing control packets to or from another ATM switch 300 over the communication line to get topology information on each ATM switch and to keep topology information up to date. Topology information which is kept up to date in this manner keeps the ATM switch 100 informed of which ATM switches and terminals are available for use.

Detailed Description Text (17):
The significant change detection module 33 turns on the flag 33a upon detection of a pre-determined state in the network. In this embodiment, the significant change detection module 33 turns on the flag 33a (a) when the address information or link information of the ATM switch 100 is changed or (b) when a PNNI routing control packet indicating that the address information or link information of another ATM switch 300 is changed. Note that address information and link information may change according to how they are used for control.

Detailed Description Text (19):
The ATM switch 100 exchanges PNNI routing control packets with other ATM switches to keep address information and link information up to date for use as topology information. And, based on this topology information, the ATM determines a route to each terminal or switch in the network and keeps this routing information as the routing information 24. When the ATM receives an SVC connection request, it references the routing information 24 to find the best route to the destination terminal or switch.

Current US Cross Reference Classification (2):
709/242

Other Reference Publication (1):
af-pnni-0055.000 Letter Ballot, ATM Forum Technical Committee, pp. 36-37, 15-17, 357-364 and 40.

CLAIMS:

2. A network control system which controls switched virtual connection on a network, containing a plurality of interconnected switches each having an asynchronous transfer mode interface, by referencing routing information generated by exchanging PNNI routing control packets, the network control system comprising:

a significant change detection module setting a significant change detection flag to on upon detecting a pre-determined condition on the network;

a first timer generating a time-out signal at a specific interval;

a second timer generating a time-out signal at an interval shorter than that of the first timer; and

a routing information update control module having the routing information, unconditionally updating corresponding routing information upon receiving the time-out signal from the first timer, and updating the routing information upon receiving the time-out signal from the second timer only if the significant change detection flag is on.

6. Document ID: US 5828844 A

L14: Entry 6 of 6 File: USPT Oct 27, 1998

DOCUMENT-IDENTIFIER: US 5828844 A
TITLE: Internet NCP over ATM

Detailed Description Text (5):
Although both the IP and ATM routing protocols employed in the Classical IP model may determine reachability information for the same hosts, they run independently of one another. For example, IP routers run routing protocols such as RIP and OSPF exchange reachability information pertinent to IP destinations. Likewise, ATM switches run independent protocols such as PNNI to determine ATM network topology and address reachability. Typically, separate IP routers and ATM switches are provided. In fact, many networking scenarios even employ different IP and ATM network topologies.

Detailed Description Text (14):
Recently, a single device known as an IP switch has been developed. An IP switch integrates a conventional router and ATM switch to route IP over ATM networks much more efficiently than in the traditional model, which employs distinct devices. The IP over ATM model may be substantially simplified if the router and the ATM switch physically reside in the same device, as illustrated in FIG. 3. As previously mentioned, when the functionality of an ATM switch and an IP router reside on separate devices, the ATM switch does not have knowledge pertaining to routing and addressing at the IP layer. In contrast, when the functionality of an ATM switch and an IP router are merged onto the same device, it becomes possible to further integrate routing at the IP level into routing at the ATM level. For example, a perfect topology match is achieved when a layer two node (an ATM switch) is physically integrated into a layer three node (an IP router). Although this configuration does not eliminate the problem of matching an IP address with its corresponding ATM address, the elimination of the topological mismatch creates the opportunity to use a single routing protocol for routing at both the IP and ATM layers. An Illustrative protocol that may serve in this capacity includes I-PNNI (see R. Callon, Relationship Between MPOA and I-PNNI, April 1996, ATM Forum 96-0352), which has been submitted to the ATM Forum to integrate routing at the IPO layer into PNNI. I-PNNI facilitates the bootstrapping and ongoing operation of Internet routing protocols and associated packet forwarding protocols over an ATM network.

Detailed Description Text (27):
The address databases may be implemented in any convenient manner. Two possible implementations are a fully distributed implementation and a fully duplicated implementation. In the fully distributed approach, each IP switch only maintains an address database for those end-points that access the Internet at that particular IP switch. Accordingly, there is no need for synchronization among different address databases in different IP switches. For example, when a source end-point sends an address query to its IP switch regarding a destination end-point and the IP to ATM address correspondence is not found in the queried IP switch, the switch will forward the request only to the IP switch responsible for the destination end-point. In a fully distributed arrangement, the Internet NCP serves as the master

database that stores all provisioned information for the network, including the IP to ATM address correspondences. When a change in the address database of an IP switch occurs (due to a host disconnecting from the IP switch, for example), the same change is forwarded to the Internet NCP to update the master database. Similarly, when the Internet NCP is modified by the service provider or the user, the appropriate individual address database(s) within the IP switch(es) will be updated accordingly.

Detailed Description Text (28):
If the address databases 56 are configured in a fully-duplicated arrangement, each IP switch maintains the database for all the end-points. When a new database entry is registered with a given IP switch, that registration is sent to all other IP switches. Accordingly, the address databases of all the IP switches are identical. That is, while the Internet NCP contains the master copy of the database, each IP switch maintains its own complete copy of the database. Similar to the fully distributed arrangement, if an IP switch makes a change in its database, the change will be reflected in all the other address databases, including the master database of the Internet NCP. Likewise, if a change is made to the Internet NCP database, it will be reflected in all the other address databases.

Current US Original Classification (1):
709/228

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw De

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L2	L1 and ((replace$ or updat$) with (address$ adj2 compar$))	27	L2
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END OF SEARCH HISTORY